# NAVAL POSTGRADUATE SCHOOL
## Monterey, California


# THESIS

**AN ANALYSIS OF THE RETENTION EFFECT OF USING LUMP SUM PAYMENTS FOR THE U. S. MARINE CORPS SELECTIVE REENLISTMENT BONUS PROGRAM**

by

David L. Ross

March 2000

Thesis Advisor: Stephen L. Mehay
Associate Advisor: John T. Warner

**Approved for public release; distribution is unlimited.**

# REPORT DOCUMENTATION PAGE

*Form Approved*
*OMB No. 0704-0188*



| 1. AGENCY USE ONLY *(Leave blank)* | 2. REPORT DATE | 3. REPORT TYPE AND DATES COVERED |
|---|---|---|
| | March 2000 | Master's Thesis |

| 4. TITLE AND SUBTITLE : An Analysis of the Effect of Using Lump Sum Payments for the U. S. Marine Corps Selective Reenlistment Bonus Program | 5. FUNDING NUMBERS |
|---|---|
| 6. AUTHOR(S): Ross, David L. | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br>Naval Postgraduate School<br>Monterey, CA 93943-5000 | 8. PERFORMING ORGANIZATION REPORT NUMBER |
| 9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)<br>N/A | 10. SPONSORING / MONITORING AGENCY REPORT NUMBER |

11. SUPPLEMENTARY NOTES: The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

| 12a. DISTRIBUTION / AVAILABILITY STATEMENT | 12b. DISTRIBUTION CODE |
|---|---|
| Approved for public release; distribution is unlimited. | |

13. ABSTRACT *(maximum 200 words)* This thesis examines the estimated effects on enlisted retention in the Marine Corps of changing the Selective Reenlistment Bonus (SRB) payment method to lump sum. The thesis surveys the literature on personal discount rates (PDR) and on models of enlisted retention. The thesis analyzes the potential effect of the payment method on retention of Zone A eligible personnel using a range of PDRs and retention elasticities estimated by the Center for Naval Analyses. The NPV of a lump sum payment was compared to that of the current payment method using the actual SRB multiples for each USMC Occupational Field. The results indicate Zone A first-term Marine retention will increase between 6.8 percent and 11.7 percent if the SRB payment were made in lump sum. The effect of switching to a lump sum payment was also analyzed using the Annualized Cost of Leaving (ACOL) model. The ACOL model estimates reinforced the estimates predicted by this thesis. Finally, a Monte Carlo simulation was run in Microsoft Excel to estimate the probabilities of attaining a given number of Marines across all Occupational Fields. The Monte Carlo simulation runs show an increased probability of obtaining a given number of first-term Marines by changing the SRB payment method to lump sum.

| 14. SUBJECT TERMS | 15. NUMBER OF PAGES |
|---|---|
| United States Marine Corps, Selective Reenlistment Bonus (SRB), Personal Discount Rate, Monte Carlo Simulation, Lump Sum, Military Manpower, Policy Analysis, Retention, Zone A, Net Present Value, First-Term Alignment Plan (FTAP), Policy Analysis. | 82 |
| | 16. PRICE CODE |

| 17. SECURITY CLASSIFICATION OF REPORT | 18. SECURITY CLASSIFICATION OF THIS PAGE | 19. SECURITY CLASSIFICATION OF ABSTRACT | 20. LIMITATION OF ABSTRACT |
|---|---|---|---|
| Unclassified | Unclassified | Unclassified | UL |

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89)

THIS PAGE INTENTIONALLY LEFT BLANK

**Approved for public release; distribution is unlimited**

# AN ANALYSIS OF THE RETENTION EFFECT OF USING LUMP SUM PAYMENTS FOR THE U. S. MARINE CORPS SELECTIVE REENLISTMENT BONUS PROGRAM

David L. Ross
Major, United States Marine Corps
B.B.A., Iowa State University, 1987

Submitted in partial fulfillment of the
requirements for the degree of

**MASTER OF SCIENCE IN MANAGEMENT**

from the

**NAVAL POSTGRADUATE SCHOOL**
**March 2000**

Author: David L. Ross

Stephen L. Mehay, Thesis Advisor

John T. Warner, Associate Advisor

Reuben T. Harris, Chairman
Department of Systems Management

THIS PAGE INTENTIONALLY LEFT BLANK

## ABSTRACT

This thesis examines the estimated effects on enlisted retention in the Marine Corps of changing the Selective Reenlistment Bonus (SRB) payment method to lump sum. The thesis surveys the literature on personal discount rates (PDR) and on models of enlisted retention. The thesis analyzes the potential effect of the payment method on retention of Zone A eligible personnel using a range of PDRs and retention elasticities estimated by the Center for Naval Analyses. The NPV of a lump sum payment was compared to that of the current payment method using the actual SRB multiples for each USMC Occupational Field. The results indicate Zone A first-term Marine retention will increase between 6.8 percent and 11.7 percent if the SRB payment were made in lump sum. The effect of switching to a lump sum payment was also analyzed using the Annualized Cost of Leaving (ACOL) model. The ACOL model estimates reinforced the estimates predicted by this thesis. Finally, a Monte Carlo simulation was run in Microsoft Excel to estimate the probabilities of attaining a given number of Marines across all Occupational Fields. The Monte Carlo simulation runs show an increased probability of obtaining a given number of first-term Marines by changing the SRB payment method to lump sum.

THIS PAGE INTENTIONALLY LEFT BLANK

# TABLE OF CONTENTS


**I. INTRODUCTION** ..... 1

A. PURPOSE ..... 1
B. PROBLEM ..... 1
C. BACKGROUND / HISTORY OF SRB PAYMENT PLAN ..... 3
D. SCOPE AND LIMITATIONS ..... 6
E. RESEARCH QUESTIONS ..... 7
1. Primary Question ..... 7
2. Subsidiary Questions ..... 7
F. METHODOLOGY ..... 8
G. ORGANIZATION OF THE STUDY ..... 9
H. BENEFITS OF STUDY ..... 9

**II. THE ANNUALIZED COST OF LEAVING (ACOL) MODEL** ..... 11

A. BASIC ACOL THEORY ..... 11
B. ACOL VARIABLES ..... 13
C. ADVANTAGES AND DISADVANTAGES OF ACOL ..... 15
D. HOW THE SRB FITS INTO ACOL ..... 16
E. CHAPTER SUMMARY ..... 17

**III. THE TIME VALUE OF MONEY** ..... 19

A. THE CONCEPT OF NET PRESENT VALUE (NPV) ..... 19
B. THE CONCEPT OF PERSONAL DISCOUNT RATE (PDR) ..... 20
C. DIFFERENCES IN PERSONAL DISCOUNT RATES BY DEMOGRAPHIC GROUP ..... 22
D. ANALYSES OF PERSONAL DISCOUNT RATES ..... 24
1. Methodology of Prior Studies ..... 24
2. Predicted Rates ..... 26
E. ADVANTAGES AND DISADVANTAGES OF THE LUMP SUM PAYMENT METHOD ..... 31
1. Advantages of the Lump Sum Payment Method ..... 31
2. Disadvantages of the Lump Sum Payment Method ..... 33
F. CHAPTER SUMMARY ..... 35

**IV. ESTIMATES OF EFFECT OF LUMP SUM SRB ON REENLISTMENT RATES** ..... 37

A. METHODOLOGY ..... 37
1. Review of PDR Estimates ..... 37
2. Review of USMC SRB Planning / Budgeting Process ..... 37
3. Methodology for Analyzing SRB Payment Methods ..... 41
4. Possible Model Outputs ..... 43
B. RESULTS ..... 43
1. Change in Predicted Retention From Using Lump Sum Method ..... 43
2. Change in Predicted Retention Holding Reenlistment Requirement Constant ..... 47
3. Annualized Cost of Leaving (ACOL) Model Comparison ..... 49
C. CHAPTER SUMMARY ..... 52

**V. MONTE CARLO SIMULATION OF PERSONAL DISCOUNT RATES AND USMC RETENTION ELASTICITIES (BY USMC OCCUPATIONAL FIELD)** ..... 53

A. MONTE CARLO SIMULATION ..... 53
B. EXCEL BASED MONTE CARLO SIMULATION MODEL ..... 54
1. How the Model Works ..... 54
2. Model Methodology ..... 54

C. RESULTS ..... 59
D. CHAPTER SUMMARY ..... 65

**VI. CONCLUSIONS ..... 67**

A. RETENTION ..... 67
B. PERSONAL DISCOUNT RATE ..... 68
C. EFFECTS OF SRB PAYMENT METHOD CHANGE ..... 69
D. ASSOCIATED ADVANTAGES AND DISADVANTAGES ..... 70
E. AREAS FOR FUTURE RESEARCH ..... 71
F. RECOMMENDATION ..... 72

**APPENDIX A ..... 75**

**LIST OF REFERENCES ..... 77**

**INITIAL DISTRIBUTION LIST ..... 81**

ACKNOWLEDGEMENTS

I would like to deeply thank Dr. Stephen Mehay for his enduring patience and timely remarks and inputs to this thesis. A student could not ask for a better thesis advisor. I would also like to thank Dr. John Warner, Professor of Economics, Clemson University, Dr. Pat Mackin from SAG Corporation, Dr. Aline Quester from the Center for Naval Analysis, Mr. Steve Cylke, and Mr. Anton Rowe for their invaluable inputs and time in helping me write this thesis. Special thanks to Major Cheryl Fitzgerald (MPP-20) who was always quick in providing Marine Corps data and information to me. I'd like to especially thank my wife Robyn; her love and support have made my every accomplishment possible. Also, thanks to the troops in my life, Hailey and Garrett, who have taught me so much about living. Finally, I'd like to thank Mr. Dave Cook from Campus Crusade for Christ who has been a mentor, a role model, and helped set my priorities straight in my walk and relationship with Jesus Christ.

THIS PAGE INTENTIONALLY LEFT BLANK

# I. INTRODUCTION

## A. PURPOSE

The purpose of this research is to analyze the effects of changing the Marine Corps' Selective Reenlistment Bonus (SRB) to a lump sum payment method. The goal is to research personal discount rates (PDRs) and Marine occupational field labor supply (retention) elasticities to gain a better understanding of the implications of implementing the proposed lump sum payment. The primary goal is to predict the increase in retention that would result from implementing the new payment system. In addition, this research aims to assess the likely range in predicted retention behavior based on different assumptions about key parameters. Finally, the research aims to analyze the costs and benefits of changing the payment method to lump sum as well as an understanding of the key factors that affect the impact of the proposed SRB payment method change.

## B. PROBLEM

In recent years, the viability of the All Volunteer Force (AVF), which was born in 1974, has become a topic of much discussion both inside and outside of the Capital beltway. The economy of the late 1990's has performed remarkably well, unemployment rates remain low, and recruiting young men and women has become harder than ever before. At the same time, the military's requirement for highly educated personnel has increased in direct proportion to the increase in warfighting technology. Another complicating factor for the AVF is the growth in the number of young adults who are aspiring to obtain a college degree, which further reduces the military's recruiting market.

These factors (and others) have contributed not only to several of the military Services missing their recruiting goal, but also to the feeling among military personnel planners that the ability to man the "career force" beyond the first-term is reaching a critical point. The robust economy has worsened military retention as well as entry-level recruiting. When confronted with the cause of their manpower problem, military personnel experts have examined internal factors such as leadership, operational tempo, and work hours as long-term solutions to the career force manning problem. Although the Department of Defense has been aware of and taken action towards reducing the military's recruiting and retention problems for over six years, the military is still facing very real recruiting and retention problems as we enter the 21st Century.

In an August 1999 survey report, the Government Accounting Office stated that: "Dissatisfaction and intentions to leave the military were more apparent among enlisted personnel than officers. On average, 52 percent of enlisted personnel surveyed said they were dissatisfied with the military, whereas 46 percent of officers were dissatisfied. Similarly, 62 percent of enlisted personnel surveyed said that they intend to leave the military after their current obligation is up, whereas 40 percent of officers said they intend to leave." [Ref 1: p 2]

More recently, Marine Administrative Message 030/00 announced the following: "Our progress to date indicates reenlistment rates for Fiscal Year (FY) 2000 (actual reenlistments executed) do not compare favorably with those for the same period in FY 1999. Reenlistments authorized in FY 2000 have increased by 13 percentage points. Reenlistment execution rates have decreased by 12 percentage points. Fifty-five percent of all FY 2000 boatspaces have been executed, and 2,375 boatspaces remain. At this

same time last year, sixty-seven percent of all FY 1999 boatspaces had been executed, and only 1,556 boatspaces remained. Thirty-seven Marine Occupation Specialties (MOS) have closed, as compared with 52 MOSs during the same period in FY 1999." [Ref 2: p 1] In short, retention has suffered.

In an "up or out" manpower system, retention problems today can have a "ripple" effect in future years as billets in higher pay grades and experience cells go unfilled. The focus of this thesis will be on one of the primary short-term retention "tools" available to Marine Corps manpower planners to reduce the enlisted retention challenges of the 21st Century; the Zone A Selective Reenlistment Bonus (SRB) program.

## C. BACKGROUND / HISTORY OF SRB PAYMENT PLAN

A short-term (in the trenches) tool used by military manpower planners to alter retention behavior focuses on the monetary aspects of retention. "Other things being equal, larger bonuses or higher levels of military pay relative to civilian pay are associated with higher enlistment rates." [Ref 3: p 6] One of the major tools used by military manpower planners to retain and shape the enlisted career force is the Selective Reenlistment Bonus (SRB) program.

The current SRB program can be traced to 1965, when the services began to experience increasing problems in first-term retention and career manning in a number of technical skills with high training costs. As a result, Congress established the Variable Reenlistment Bonus program in 1965. [Ref 4: p 2] In 1974, Congress, in Title 37, Section 308 of the United States Code authorized the Selective Reenlistment Program to replace the Variable Reenlistment program.

Prior to April 1979, reenlistment bonuses were paid in annual installments over the individual's reenlistment period. Beginning on 1 April 1979, however, the entire bonus was paid in a lump sum at the date of reenlistment, though the undiscounted value of the bonus remained the same for reenlistments of the same length. [Ref 5: p 1] The lump sum payment increased the net present value (NPV) of the bonus to the service members receiving it.

Starting in February 1982 through the time of this writing (Spring 2000), the SRB payment method was changed such that half of the bonus award is paid in a lump sum at the time of reenlistment with the remainder of the contract amount being paid in equal installments on the reenlistment-contract anniversary date. [Ref 6: p AI 7] The intent of the SRB program today remains similar to its original purpose, "To influence personnel inventories in specific situations in which less costly methods have proven inadequate or impractical." [Ref 7: p 2]

At the time of this writing, SRBs are authorized in section 4.3.3.1 of the Department of Defense (DoD) Directive 1304.21 to be paid using a lump sum payment method. However, section 8021 of the Fiscal Year (FY) 2000 budget specifically states that, "Notwithstanding any other provision of law, none of the funds appropriated by this Act shall be available to pay more than 50 per centum of an amount paid to any person under section 308 of title 37, United States Code, in a lump sum."

SRBs are used at three control points in an enlisted Marine's career. The first control point is Zone A which occurs after the Marine has completed his first enlistment obligation. Currently there are several different lengths of initial service contracts

reaching their first reenlistment point; however, almost all new Marine Corps enlistment contracts currently are for a four year duration.

The Marine Corps has three control points (or zones) to which Marines are eligible to be paid a reenlistment bonus. They are Zone A (reenlistments executed between 21 months and 6 years of continuous service), Zone B (reenlistments executed between 6 and 10 years of continuous service) and Zone C (reenlistments executed between 10 and 14 years of continuous service). Because of the constraints imposed on the military manpower structure of "growing their own" (no lateral transfer into the ranks), the most critical reenlistment point for the Marine Corps career force planners is the Zone A reenlistment point.

Marines cannot receive more than one SRB in either Zone A, B, or C, limiting them to a maximum of three possible SRB opportunities (if their Occupational Specialty was eligible for the SRB at points of time when the Marine was in Zone A, B, and C). The SRB is also "capped" by Marine Corps Order (MCO) 7220.24M (7 May 1990), so as to not exceed $45,000 for any one zone. Marine Corps policy, however, caps bonus payments at $30,000 for Zone A payments and $20,000 for Zone B and C payments. [Ref 8]

Under the current SRB structure 50 percent of the SRB is paid in the first year with the remaining 50 percent distributed evenly over the remaining reenlistment contract period. Young men and women (especially those who join the military) have been observed to have very high personal discount rates (PDR). A personal discount rate represents an individual's preferences for having money today vice waiting for a future date to obtain an even larger amount of money. Estimates of PDRs today for most youth

range in the 16 to 30 percent range, which means they would be indifferent to the choice of having $1,000 today vice $1,160 to $1,220 a year from today (depending upon which PDR is used).

With such seemingly high PDRs expressed by our junior enlisted, changing the SRB pay out method from its current state to one of a lump-sum method has the potential to increase the value that Zone A personnel place on the SRB. This increased value has the potential to increase reenlistment rates using the same amount of budgetary dollars (or to achieve the same reenlistment rate for a lower budgetary expenditure).

There are, however, several problems with determining the magnitude of the effect of the "lump sum SRB" system. Among these are the uncertainties surrounding the "correct" PDR rate to use to determine the net present value of the SRB and the uncertainties surrounding the occupational field retention elasticities for a given amount of SRB. This uncertainty was expressed by the current Marine Corps' SRB planner (Major Cheryl Fitzgerald), and by Dr. Aline Quester (CNA analyst) to the author. That is, we don't know for certain the value that enlistees place on future dollars, nor the effect of a dollar's worth of SRB payments on retention decisions.

## D. SCOPE AND LIMITATIONS

The scope of this thesis will include an intense literature review to determine the range of PDRs and retention elasticities (by occupational field) that have been estimated by prior research. Second, these estimates will be used to compute the change in the net present value of a lump sum SRB payment plan versus the current payment method. This literature review will also include a historical perspective of the pros and cons of going to a lump sum SRB payment plan. It will include a sensitivity analysis using best "point"

estimates to determine if the Marine Corps can increase retention rates by using the same amounts of budgeted SRB funds.

Finally, using a Microsoft Excel based computer program called Insight.XLA, this thesis will analyze the results of a Monte Carlo simulation run using a "range" of PDRs and a "range" of labor supply elasticities on Marine occupational (skill) fields. Due to time constraints, this model will be used specifically for processing data for analysis by this thesis. It is a fairly "user friendly" model but will require additional work to allow an unfamiliar "user" to operate it. With minimal training, the current model could be used by the Marine Corps' Career Planner(s) to get a better understanding of "predicted" reenlistment rates and the "uncertainties" surrounding these forecasts. This thesis will focus solely on Zone A reenlistments and will not investigate SRB policy change impacts on Zones B or C.

## E. RESEARCH QUESTIONS

### 1. Primary Question

The primary research question that this thesis will address is: What is a reasonable forecast for the change in first term retention levels as a result of changing the SRB payment method to lump sum?

### 2. Subsidiary Questions

The subsidiary research questions are as follows:

- What is an applicable personal discount rate (point estimate and range of estimates) for an enlisted Marine reaching his/her zone A reenlistment point?
- What is an applicable SRB military labor supply elasticity at the first-term reenlistment point?

- What are the costs and benefits of changing the USMC SRB payment method policy from the current 50 percent first year plan to a lump sum first year plan?

- What are the results of a sensitivity analysis performed on changing the SRB payment from the current method of paying 50 percent up front to a policy of 100 percent lump sum payment?

- What are the insights realized by running Monte Carlo Simulations (by "selected occupational fields) with alternative PDR's and alternative labor supply (retention) elasticities on a proposed lump sum SRB payment method?

## F. METHODOLOGY

The methodology used in this thesis research consists of the following steps: (1) a literature search of books, magazine articles, CD-ROM systems, and other library information resources; (2) interviews with personnel from MPP-20, The Center for Naval Analysis (CNA), and other retention experts; (3) a "sensitivity analysis" of the retention effects of changing the SRB payment method from its current payment plan to a lump sum payment plan using the most reasonable "point" estimates for PDRs and USMC occupational field labor supply elasticities; (4) a Microsoft Excel model using the computer program INSIGHT.XLA to run a Monte Carlo simulation on a "range" of most likely PDRs and occupational field labor supply elasticities to determine the retention effects of changing the SRB payment method; and (5) a simulation of the effect of switching to a lump sum payment method on reenlistment in Navy ratings using the Navy's ACOL reenlistment model and compare this to "selected" Marine Corps Occupational Fields.

## G. ORGANIZATION OF THE STUDY

**Chapter I**. Introduction. Identifies the focus and purpose of the thesis and states the primary and subsidiary research questions.

**Chapter II**. The Annualized Cost of Leaving (ACOL) model. This chapter provides an overview of one of the most respected and widely used manpower models used to predict "stay or leave" behavior by military personnel.

**Chapter III**. The Time Value of Money. This chapter provides an overview of determining Net Present Value and how Personal Discount Rates (PDR) can vary between individuals.

**Chapter IV**. Estimates of Effect of Lump Sum SRB on Reenlistment Rates This chapter outlines the methodology this thesis uses in determining the effects of PDRs and their effects on retention. This chapter will also perform a sensitivity analysis using the ACOL model on selected "similar" Navy Occupational Fields and compare the results.

**Chapter V**. Monte Carlo Simulation of PDRs and USMC Retention Elasticities. This chapter describes the methodology used in performing the Monte Carlo simulation on "selected" Marine Occupational fields and reports the Monte Carlo simulation results.

**Chapter VI**. Conclusions and Recommendations. The final chapter summarizes the findings of the research, summarizes the lessons learned, provides recommendations from this study, and provides recommendations for future research.

## H. BENEFITS OF STUDY

This study will provide the necessary information required to make a sound decision by the USMC and other policy decision makers as to the possible implementation of a change in its policy of paying out the SRB. This study will provide

the USMC with additional insight into the costs and benefits of going to a lump sum SRB payment method.

## II. THE ANNUALIZED COST OF LEAVING (ACOL) MODEL

### A. BASIC ACOL THEORY

The Annualized Cost Of Leaving (ACOL) model was first developed by Dr. John T. Warner and Gary Nelson to analyze potential changes to the military retirement system. [Ref 9: p 6] Prior to this time, the Navy planned retention and enlistment estimates based on historical data. This "historical based" system did not lend itself to having a lot of precision during time periods of rapidly changing economic environments.

The theory behind the ACOL model is that service members make their separation decision based on the "utility" they will derive from their "stay" or "leave" choice. "Positive economics" is a theory in which people are assumed to seek out "benefits" while minimizing "costs". [Ref 10: p 3] One assumption of positive economic theory is that people behave and make decisions rationally. "When considering *persons*, economists assume that the objective being pursued is *utility maximization*; that is, people are assumed to strive toward the goal of making themselves as happy as they can (given their limited resources). Utility, of course, encompasses both pecuniary and nonpecuniary dimensions." [Ref 10: p 4] Pecuniary refers almost entirely to "money or salary" while nonpecuniary refers to other aspects of a person's life (job satisfaction, work environment, free time, job demands, etc.).

The individual then strives to maximize his/her utility or the total "satisfaction" derived from the economic and life situations they are in. If a service member has the potential to increase his/her utility by leaving the service, he/she will pursue an occupation in the civilian labor market and will experience more "happiness" in his/her life by making this decision. If a service member feels they will decrease their utility by

leaving the service they will stay in the military and they will experience more "happiness" in their lives due to this decision.

The ACOL model encompasses positive economic theory by encompassing all aspects of the "stay or leave" decision. It not only captures expected future income streams but also attempts to assign equivalent monetary values to the nonpecuniary aspects of making a career out of the military. The ACOL model looks at a person's potential income streams and the value of nonpecuniary factors (such as a preference for military life or a distaste for military life) and discounts them back to current dollars to determine a value for staying in the military or for leaving the military and pursuing a job in the civilian labor sector. The cost-of-leaving is the difference between the value of the civilian option and the military option (in dollar amounts). If the ACOL (cost-of-leaving) is positive, the individual will choose to stay in the military; if the value is negative, the individual will leave the military service.

One critical aspect of the ACOL model is the derivation of the time horizon to use in its computation. The model can be used for any time horizon; however, a positive ACOL value for any time horizon predicts the individual will be better off "staying in" at the present time. The ACOL model is a very complex computation as it takes into account many variables (to be discussed later) and places a dollar value or net (positive or negative) effect on each. Two critical aspects of the ACOL model are the determination of the "discount rate" when determining the net present value of the cost of leaving and the determination of the maximum length "time horizon" to use. These factors will be discussed later in this chapter.

## B. ACOL VARIABLES

When deciding upon whether to stay in or get out of the military as a job career, "One searches over all possible lengths of stay to determine the optimal length of stay at a given decision point. The financial returns associated with the optimal length of stay are then compared with the financial incentive of leaving immediately. The ACOL value is the net financial incentive to stay if positive or leave if negative. It is calculated as the annualized difference in the financial rewards from staying to the optimal leaving point relative to leaving immediately." [Ref 11: p 129]

There are many variations of the ACOL model; however, the basic approach involves developing income and preference streams for military and civilian lifestyles, discounting them into today's net present value (NPV), and subtracting the civilian NPV from the military NPV. The decision criterion of the ACOL model is based on the following: Let A(t,n) be the ACOL value for someone at time t thinking about staying n more years or leaving today. The ACOL value is the difference between the annualized pay stream from remaining n more years and the annualized pay stream if the service-member leaves the military now. Let A(t) = max (A(t,t+1), A(t,t+2), ...,A(t,N)) where N is the maximum possible career length of service. The individual will stay in the military if A(t) (the ACOL value) is greater than 0; he/she will leave the military if A(t) is negative. However, the above is true only for "taste-neutral" individuals. If an individual really enjoys the military lifestyle, he/she may obtain more utility by staying in the military. Likewise, if the individual abhors the military lifestyle, he/she may obtain more utility by choosing a civilian lifestyle even if the pay is not as attractive as his/her current military pay. [Ref 12]

Chapter 13 of the Handbook of Defense Economics, Volume 1, 1995 by John Warner and Beth Asch, presents a general mathematical explanation of the ACOL model. [Ref 13: p 360] The variables below apply to an individual rationalizing the decision to stay in or get out of the military at the present time. The following are a list of variables included in the typical ACOL model:

$W_j^M$ = the expected military pay in each future year $j$

$W_{j,t}^C$ = expected civilian earnings in future year $j$ if the individual leaves at time $t$

$W_{j,n}^C$ = expected civilian earnings in future year $j$ if the individual separates after future year $n$

$R_n$ = expected present value at future year n of retired pay and other separation benefits if the individual separates after year $n$

$R_t$ = expected present value at year t of retired pay and other separation benefits if the person leaves now

$\tau^m$ = preference for the military lifestyle

$\tau^c$ = preference for the civilian lifestyle

$\rho$ = the individual's subjective discount rate on future income

$S_{t,n}$ = the present value of the future benefit from staying from period $t$ to period $n$

$L_t$ = The value of leaving immediately

$C_{t,n}$ = The cost of leaving

ACOL calculates the present value of the future benefit from staying in from period $t$ through period $n$ ($S_{t,n}$) as:

$$S_{t,n} = \sum \frac{W_j^M}{(1+\rho)^{j-t}} + \frac{R_n}{(1+\rho)^{n-t}} + \sum_{j=t+1}^{n} \frac{\tau^m}{(1+\rho)^{j-t}} + \sum_{j=n+1}^{\infty} \frac{W_{j,n}^C + \tau^c}{(1+\rho)^{j-t}} \qquad \textbf{Equation 1.}$$

The value of leaving immediately is:

$$L_t = \sum_{j=n+1}^{\infty} \frac{W_{j,t}^{C} + \tau^{c}}{(1+\rho)^{j-t}} + R_t \qquad \textbf{Equation 2.}$$

The Annualized Cost of Leaving therefore is $S_{t,n} - L_t$. If the value is positive for any time horizon, the model predicts the service member will choose to stay in the military. If the calculated value is negative, the model predicts the service member will choose to leave military service (assuming military/civilian "taste-neutral" individuals).

## C. ADVANTAGES AND DISADVANTAGES OF ACOL

The primary advantage of the ACOL model is that it fully incorporates all aspects of the service member's decision to stay in or leave the military. It is by far the most "encompassing" manpower model to date. Observed characteristics and unobserved characteristics of the "stay" or "leave" decision are all taken into account. The ACOL model also does not focus on just one time frame but encompasses many future time horizons over which the individual may be making his/her decision.

One of the major disadvantages of the ACOL model is the amount of data that must be acquired to output accurate retention forecasts. Quester and Adedeji note, "The main difficulty with the ACOL methodology is that it has been difficult to update (or predict) these expected pay streams accurately." [Ref 3: p 8] From the Marine Corps' perspective, switching to the ACOL model would take considerable reprogramming efforts; however, the data needed to run the ACOL model for Marine Corps Occupational Fields is available.

Another weakness with the ACOL model is the time horizon used in the calculation. The ACOL model uses many different time periods in computing the "stay or leave" decision. However, the longest time period used normally takes the service member to the 20 years of service (YOS) mark at which time he/she is "cliff" vested into the military's retirement system. This makes sense in that the retirement figures are fairly stable (known) and the retirement benefit may have a significant impact on decisions to stay or leave military service. However, with any forecasting model, the further out the forecast goes, the less accurate the results may become. The ACOL model makes sense in maximizing the time horizon at the 20 YOS mark because of the great uncertainties associated with longer forecast periods. However, the weakness associated with this technique is that it may ignore an individual's "lifetime" preferences (utility) when only taking the military service member to between 38 and 42 years of age in its computation. In other words, ACOL may predict a positive "cost-of-leaving" value somewhere in the service member's time horizon to the 20 years-of-service point. However, the possibility exists that had a 40 or 50 year time horizon been used, the model may predict only negative cost-of-leaving values throughout the specified time period (which would indicate more "utility" in the civilian market). Factors such as increased 401K savings (time horizon minimum of 59 ½ years of age), more family stability, community work, etc. may sway a service member's decision, but may occur after the service member's 20 YOS mark.

## D. HOW THE SRB FITS INTO ACOL

The Selective Reenlistment Bonus (SRB) is incorporated into the ACOL model via $W_j^M$, the expected military pay in each future year (see Equation 1 above). Although

it is only one aspect of the ACOL model, the SRB increases the cost-of-leaving. As in any decision among individuals associated with a group, many military members will be on the margin about staying in the military. The SRB payment will turn some negative ACOL values into positive ones and thus induce more military personnel to choose the stay option.

Under the current SRB payment method, the ACOL model, half of the SRB will contribute to the discounted value of the military pay in $t = 0$ with the rest of the SRB payment contributing in time period 1, 2, and 3. Under the proposed lump sum SRB payment method, all of the SRB would impact military pay in $t = 0$. Thus, the ACOL model predicts that a change to the lump sum payment method will increase military personnel retention because the NPV of a given SRB bonus will be greater under the lump sum method. The higher the personal discount rate used, the more effective the lump sum payment method will be in the ACOL model. We will examine the effects of the proposed payment change using the ACOL model in Chapter IV. We would expect the overall ACOL value to increase when the SRB payment method is changed to lump sum (holding everything else constant). Individual personal discount rates (PDR) will be discussed in the next chapter.

## E. CHAPTER SUMMARY

This chapter has identified the Annualized Cost of Leaving model and the variables it uses. The ACOL model is the most comprehensive manpower retention model available today and is the military manpower planner's model of choice. However, ACOL has the disadvantages of requiring large amounts of input data and a somewhat "fixed" maximum time horizon. The SRB fits nicely into the military

compensation portion of the ACOL model and is just one input to the ACOL which encourages greater retention numbers.

## III. THE TIME VALUE OF MONEY

### A. THE CONCEPT OF NET PRESENT VALUE (NPV)

Net present value (NPV) is a financial concept that enables decision-makers to decide which alternative action will make them "better off". This "decision" could apply to many different "levels" of decision making, from a decision to start up a new company by the Chief Executive Officer (CEO) of an existing company to a decision by a junior enlisted service member to pay cash or charge his/her groceries at the commissary. Although the CEO's decision will most likely be more thought out and involve many reports and detailed analysis, the decision by the junior enlisted service member will also incorporate the "time value of money" in its making.

"Net present value is computed by assigning monetary values to benefits and costs, discounting future benefits and costs using an appropriate discount rate, and subtracting the sum total of discounted costs from the sum total of discounted benefits." [Ref 14: p 3] By discounting "gains" and "losses" which may occur in future time periods back to the present period, policy makers have an easy, single "unit of measurement" to use when making a decision today. The greatest monetary value of an alternative decision is not always the best route to follow because other factors (such as personal preferences, needs of society, desire for certain outcome) also may play a role in the decision.

Of key importance is the discount "rate" used by a decision-maker when determining a NPV. If one values current consumption far greater than future consumption, he/she will use a high discount rate which will greatly reduce the NPV of expected future pay streams. If one values future consumption more than current

consumption, he/she will use a very low discount rate which will cause the NPV of a given future pay stream to be higher.

Net present value is calculated first by determining what the future pay streams will be, when they will occur, and how long they will occur for. Using the current payment method of the Selective Reenlistment Bonus (SRB) as an example, a service member knows what his/her future payments will be and when they will be made. Using an SRB amount of $10,000, the service member will receive $5,000 today (t = 0), $1,667 ($5,000 divided by the three remaining anniversary dates of his/her contract) in one year (t = 1), $1,667 in year two (t = 2), and $1,667 in year three (t = 3) for a total payment of $10,000. The service member's "value" of this payment, however, would not be $10,000 but something less than this amount depending on his/her preference for current consumption. If the service member adopted a personal discount rate "r" of 21 percent, the NPV of the SRB contract would drop to $8,457 (see equation 3 below).

$$\text{Net present value (NPV)} = \$5{,}000 + \frac{\$1{,}667}{(1+r)^1} + \frac{\$1{,}667}{(1+r)^2} + \frac{\$1{,}667}{(1+r)^3} = \$8{,}457 \qquad \textbf{Equation 3.}$$

If this payment were made in a lump sum up front at the reenlistment point the NPV of the SRB contract would be the full $10,000. Thus, the "choice" of the personal discount rate can have enormous effects on the determination of the NPV. This will be addressed in the next section.

## B. THE CONCEPT OF PERSONAL DISCOUNT RATE (PDR)

"The discount rate is a measure of time preference, risk, and expectation of future inflation which is affected by age, sex, race, and level of education." [Ref 15: p 2] The personal discount rate (PDR) is the rate at which "individuals" trade current for future

dollars. [Ref 16: p 1] The personal discount rate is defined in classical economic theory as "the marginal rate of substituting between consumption in the current period and consumption in the future period along a ray of equal consumption in the two periods." [Ref 16: p 4] Nord and Schmitz define the annual real PDR of an individual as "the rate of interest that will make the individual indifferent between a payment of X dollars at time t and a secured promise of a payment of X dollars plus accumulated interest at some future time t + k." [Ref 17: p 2]

The individual's PDR can be calculated in nominal terms or real terms. The nominal PDR is a discount rate which does not account for the individual's "expected" rate of inflation. The real PDR adjusts for the rate of inflation by reducing the nominal PDR to account for the expected inflation. The real discount rate basically equals the real discount rate minus the expected rate of inflation. For instance, if the expected rate of inflation were 3 percent and an individual's nominal PDR was 10 percent, his/her real PDR would be 7 percent (10 – 3). More precisely, the "Fisher Effect" calculates the real discount rate *(r)* as equal to the nominal discount rate *(i)* minus the expected inflation rate *(m)* divided by one plus the expected inflation rate. [Ref 18: p 130]

$$\text{Real Discount Rate } (r) = (i - m) / (1 + m) \qquad \textbf{Equation 4.}$$

Although the Excel spreadsheet used in this thesis allows for the computation of real discount rates (using the Fisher Effect), this thesis will focus on nominal discount rates. The logic behind this is that some prior studies were completed during periods of time that had high inflation rates while other studies were completed during periods of low inflation. By using nominal discount rates (non-inflation adjusted), this thesis will be able to better compare discount rates across various historical time periods.

In essence, the personal discount rate (PDR) is a major factor in determining the net present value (NPV) of the Selective Reenlistment Bonus (SRB) for each individual service member. This thesis does not suggest that each service member sits down and performs the calculations necessary to derive their own PDR. However, by observing service member's choices, the implied PDR can be identified.

When computing an individual's NPV of future payment streams (such as the SRB), the PDR selected will have a profound effect on the outcome value. In most cases, service members may have little idea as to what their PDR actually is and chances are that no two randomly selected service members will have the same PDR. However, several studies have been completed that show differences in implied PDRs based on demographic characteristics. The findings of these studies will be examined in the next section.

## C. DIFFERENCES IN PERSONAL DISCOUNT RATES BY DEMOGRAPHIC GROUP

The demographic group that is eligible for SRB's in Zone A in the Marine Corps is best characterized as a 22-year-old white male with a high school education. It would be nearly impossible to determine every Marine's personal discount rate (PDR) because of all the observed and unobserved factors that go into its determination. However, because the PDR used in the calculation of net present value (NPV) is so important, it is meaningful to get a feeling about how PDRs vary among demographic groups. Several studies have been completed that address this aspect of PDR.

Mackin shows that nominal discount rates of males and non-whites are higher than whites and females, which would suggest that the lump-sum alternative is more attractive to the former group than the latter. [Ref 15: p 6] Mackin also notes that there is

potential for this to apply to any delayed pay policy such as retirement pay or G.I. Bill educational benefits. Mackin cautions policy makers that one of the unintended effects of delayed payments of benefits (such as the current SRB payment method) is that certain demographic groups (such as non-whites) may be impacted disproportionately by the policy. In other words, some programs may not appeal to non-whites as much as they do to whites, thus inadvertently shaping the force in unintended ways.

Warner and Pleeter used the personal characteristics of age, race, sex, education level, number of dependents, and mental ability as demographic factors in their study to determine PDRs based on personnel decisions during the military draw-down period of the early 1990s. Their findings suggest that the characteristics of being young and black tend to increase an individual's PDR. They also found that, "Those with more education generally have significantly lower probabilities of separation, however, having more dependents does not affect the probability of separation." [Ref 16: p 16] Warner and Pleeter also estimated that blacks have a 6.3 percent higher PDR than whites. Nord and Schmitz also report that a retention program based on immediate bonuses is likely to be most favorable to inexperienced (young) personnel, minorities, singles, and non-college graduates. [Ref 17: p 22] This demographic group, for the most part, is the group that is eligible for the USMC Zone A reenlistment bonus.

Overall, the studies indicate that there are differences in individual PDRs across various demographic groups. The findings show the highest PDRs among young males, with black young males being significantly higher than whites. The reader should be aware that the consequences of the current SRB payment method may unintentionally affect the demographic make up of our force structure. Another consequence of these

differences in PDR by "demographic group" is that it makes it more difficult to pick a "single" PDR to analyze the behavior of those eligible for a Zone A reenlistment bonus.

## D. ANALYSES OF PERSONAL DISCOUNT RATES

*"Present-Value analysis is a generally accepted practice, but selecting an appropriate interest rate for discounting is subject to much controversy."* [Ref 6: p 8]

### 1. Methodology of Prior Studies

Selecting the proper interest rate to use for deriving a NPV is a well-studied topic in the finance and economic literature. There are three main types of studies that have analyzed the issue of personal discount rates: 1) Market rate studies; 2) Implicit rate studies; and 3) Direct assessment studies.

Market rate studies use economic theory to predict what a "rational" decision-maker would use for his or her discount rate. Market rate studies assume that individuals have diminishing marginal rates of "utility" on additional consumption, that there is a single "market" interest rate to use in all discounting, and that there is the potential for an individual to borrow up to his/her NPV of lifetime future earnings potential. Nord and Schmitz estimate the discount rate determined by market rate studies to range between 7.2 percent and 30 percent. [Ref 17: p 6]

The strength of market studies lie in their firm theoretical foundation. The greatest weakness of market studies is the lack of empirical evidence to support the theory they are based on. Another weakness is the determination of the proper "single" market rate of interest to use. When some mutual funds are generating over 100 percent annual rates of return in the bull stock market of the late 1990's it is easy to see that predicting a single discount rate is very difficult to do. For example, many individuals

have a related problem deciding whether to leave their savings invested in the stock market or pay down a large portion of a new home purchase.

The second approach called implicit rate studies, rely on the observed actual decisions individuals make to derive a PDR. The major strength of this approach is that it uses real decisions made by individuals who will reap or pay the consequences of their actions. The weakness of the approach is that sometimes assumptions must be made in regard to the information the decision-maker is using to make his/her decision. Another weakness of implicit rate studies is that the rate should not be taken out of context. For example, a PDR obtained by studying how people purchase an energy efficient refrigerator (or a less costly non-efficient refrigerator) should not be assumed to hold true for a person thinking about taking out a second mortgage on their home to pay for a trip to Las Vegas. Implicit rate studies have derived PDRs ranging between 1.2 percent and 39 percent. [Ref 17: p 6] The research literature concludes that if an appropriate (similar decisions with similar dollar amounts at stake) study exists, the PDR derived by such a study is the most appropriate to use in calculating an individual's NPV.

Finally, the direct assessment method uses survey data to derive an individual's PDR. The weakness of this approach lies in the fact that the decisions are merely hypothetical and the surveyed individual will not suffer any consequences of his/her choices. The respondent will also not put the time or thinking into a survey as he/she would put into a "real" monetary decision. Another problem with the direct assessment method is that the resultant PDR has the potential to be greatly affected by the wording of the survey questions.

The strengths of the direct assessment method are that the survey questions can be tailored to a decision the researcher is interested in (ie. SRB payment options could be used for this thesis), and the survey sample group can be selected from the appropriate decision-maker. For example, a survey relevant to this thesis would use military members who are approaching the completion of their first term of service. Also, with considerable attention to detail, the phrasing of the survey questions can be worded so it does not affect the survey outcome. Direct assessment studies have derived PDRs which range between 8 percent and 23 percent. [Ref 17: p 8]

### 2. Predicted Rates

From the literature review, two implicit discount rate studies stand out as being particularly applicable to the issue in this thesis. In these two studies: (a) the decision makers (individuals studied) were military service members; (b) the decisions being made were about dollar amounts similar to that of the SRB; and (c) in one case (Cylke et. al) the Selective Reenlistment Bonus payment effects were studied in a "natural experiment" when the SRB payment method changed to one of lump sum (April 1979 through January 1982). These two studies so closely resemble the research topic area that the author believes they are the most pertinent to this thesis.

Warner and Pleeter Study. In 1991 Congress directed the Department of Defense (DOD) to reduce the military's end-strength numbers by 400,000 personal. DOD was directed not to make this change in any one segment of the military (ie. not just retirement-eligible personnel). In order to implement this reduction, two programs were authorized. The first was a Voluntary Separation Incentive (VSI) program that provided an annuity to the service member at a rate of 2.5 percent of their base pay times the

number of years of service they had served. The length of the annuity was for twice the number of years the service member had already served. The other program offered was the Selective Separation Benefit (SSB), which was a lump sum payment determined by multiplying the service member's YOS by 15 percent of his/her base pay. In NPV terms, these two methods were far from equal. Using the available market "savings" interest rate of 7 percent the VSI annuity had a far greater NPV than the lump sum SSB (the magnitude of this NPV "difference" varied by YOS and pay grade).

Warner and Pleeter used a probit model and a log-linear probit model to estimate separation decisions for over 11,000 officers and 55,000 enlisted personnel between the ages of 25 and 35. Their findings estimated an average PDR for the sample of 19.8 percent. Warner and Pleeter's enlisted personnel findings are shown in Table 1 below.

| | Linear Model | Log-Linear Model |
|---|---|---|
| All | 0.354 | 0.536 |
| Stayers | 0.35 | 0.525 |
| Leavers | 0.369 | 0.572 |
| All in YOS: | | |
| 7 | 0.41 | 0.714 |
| 9 | 0.381 | 0.607 |
| 11 | 0.353 | 0.527 |
| 13 | 0.327 | 0.459 |
| 15 | 0.294 | 0.389 |

**Table 1 Warner and Pleeter's PDRs for Enlisted Personnel [Ref 16: p 29]**

At first glance, the reported PDRs for enlisted personnel appear to be implausibly high. However, Warner and Pleeter also found that the "probability of choosing the lump sum declines sharply with the after-tax lump sum amount. This result implies that individuals do in fact discount larger sums at a lower rate than smaller sums with the estimated decline of PDR by over 5 percent for each $10,000 increase in the lump sum amount." [Ref 16: p 18] The officer PDRs are reasonable in comparison to the majority of prior PDR studies.

Warner and Pleeter's officer results are shown below in Table 2

| | Linear Model | Log-Linear Model |
|---|---|---|
| All | 0.104 | 0.187 |
| Stayers | 0.099 | 0.182 |
| Leavers | 0.129 | 0.21 |
| All in YOS: | | |
| 7 | 0.205 | 0.291 |
| 9 | 0.159 | 0.232 |
| 11 | 0.111 | 0.18 |
| 13 | 0.046 | 0.132 |
| 15 | 0 | 0.099 |

**Table 2 Warner and Pleeter's PDRs for Officers [Ref 16: p 29]**

Another relevant finding by Warner and Pleeter was that the PDR varied with the time delay of the payment stream. "Individuals appear to discount future rates hyperbolically, applying higher discount rates to amounts with a short delay." [Ref 16: p 6] This appears to be very applicable to the three-year time delay used in the current SRB payment method. When the enlisted PDRs were adjusted for the difference in total dollars impacted by the individual's decision and the demographic differences such as age and education, over half of the difference between officer and enlisted PDRs was accounted for. [Ref 16: p 20]

Cylke et al. Study. Cylke et al. examined the changes in the reenlistment rates of sailors between April 1979 and January 1982 when the SRB payment method was temporally changed to lump sum. This afforded the opportunity to study a "natural experiment" of the effectiveness of changing the SRB payment method. Cylke defined the "reenlistment rate" as "the fraction of individuals who choose to reenlist (remain in the service) among those whose initial enlistments expire within a given fiscal year."

This group is identical to the group this thesis is analyzing with the exceptions that the natural experiment applied only to the Navy and it was conducted over 20 years ago.

Cylke et al. found that the installment SRB payment method was only 71 percent as effective as the lump sum SRB payment method in retaining enlisted personnel. [Ref 5: p 7] Using a logistic regression with variables accounting for the unemployment rate and time, Cylke et al. determined that, "On the margin, Navy enlisted personnel have a 'nominal' discount rate of 29.1 percent." [Ref 5: p 11] Cylke reports most of his findings in terms of "real" discount rates; however, it should be noted that during the time of his study, he adjusted for inflation using a 10.4 percent "expected" inflation rate, which is considered to be very high in today's (2000) low-inflation economy.

The appropriate single PDR to apply to Marines completing their first term of service is still hard to identify. Rather, the author feels that a PDR range would be more practical to use in this analysis. There is a new growing business that pays individuals a lump sum amount in exchange for annuity payment streams the individuals have either earned for their retirement or have been awarded in a law suit. Although this practice has been scrutinized by the government and the exact "charge" for converting annuities to lump sum is not known, the Wall Street Journal estimates these businesses earn around a 21 percent rate of return on their business ventures. [Ref 19, p A8] The military as a group experiences a riskier lifestyle than the average civilian. Therefore, the author believes military personnel have higher PDR's than their civilian counterparts. Also, as most who are familiar with the military know, the stores outside military establishments are not short of "pawn" or "check cashing" shops that charge very high rates of interest

for their services. Therefore, this thesis will apply a PDR range for Zone A military service members from 21 percent to 41 percent, with an expected PDR of 31 percent.

## E. ADVANTAGES AND DISADVANTAGES OF THE LUMP SUM PAYMENT METHOD

As with any proposed policy change, there are several advantages and disadvantages that emerge from the literature review and from discussions with USMC manpower planners in Quantico, Virginia in regard to changing the SRB payment method to lump sum. Below are some of the major advantages and disadvantages of switching to a lump sum SRB payment method.

### 1. Advantages of the Lump Sum Payment Method

A 1985 General Accounting Office report [Ref 6: p 7-10] noted three major advantages of the lump sum payment method. The report stated that lump sum SRB payments are: 1) More cost-efficient than installment bonuses; 2) More readily visible to Congressional and DOD decision makers; and 3) Less limiting to decision-makers when fiscal reductions must be made.

The General Accounting Office (GAO) proposes that because young people tend to have a strong preference towards current consumption (as discussed above in the PDR section) they prefer current dollars over future dollars. A service member who has a real PDR of 21 percent would be indifferent between receiving $10,000 using the current SRB payment method or receiving $8,457 today. If the government's discount rate is less than the individual's PDR, the government would be "better off" paying the money in a lump sum. In January 2000, the government's official 30-year, long-term (the author considers SRBs to be long-term unless they are going to stop being paid in the near

future) nominal discount rate was 6.3 percent. [Ref 20: p 7] Using a real government rate of 9.5 percent and a real PDR of 17 percent, the 1985 GAO report estimated, "The total cost of Navy SRBs awarded during FY 1986 could be reduced by about $13 million if the lump sum method were used." [Ref 6: p 8] Presumably, the GAO analysts mean the Navy could achieve the same retention rate but at a cost that is $13 million less.

Another advantage of paying SRBs in lump sum payments cited by GAO is that it makes the "true" costs of the SRB budget more readily visible to Congressional and DOD decision-makers. The installment method incorporates an "obligation" for the government that is not reflected in the current fiscal year SRB budget. This creates hidden future year outlay obligations. Hypothetically, if a Service manpower planner requests a FY 2000 SRB budget of $300 million (of which $100 million would be used to make current anniversary payments under the installment plan), the true "total cost" of the SRB payments could be $500 million ($100 million for anniversary payments, $200 million for first year bonus payments, and $200 million of obligated payments to first-time bonus recipients). Thus, a future obligation of $200 million would be unintentionally hidden in the budget. Using the lump sum payment method, the "true" cost of the SRB program would be easily identifiable.

The third advantage of lump sum payments the GAO report notes is that lump sum SRB payments are indeed less restrictive than installment payments for Congressional and DOD decision makers in fiscally constrained times. If, for example, an across-the-board fiscal reduction was called for, DOD planners would be required to reduce SRB levels totally among the "current year" SRB-eligible manpower pool. This is because the other 50 percent of the SRB budget (installment method) are already

obligated. Thus, manpower planners may suffer more retention problems in the current year's eligible pool because they simply won't be able to offer the bonuses to incentivize reenlistments. In the military's "no lateral entry" system, this one-year problem will cascade into future time periods.

Based on the PDR research results for demographic groups, another advantage of the lump sum payment would be the elimination of any "unintentional" effects installment method payments may have on the force structure of the Marine Corps by race, age, or gender. The magnitude of this effect is only speculative; however, the research indicates the ratio of "non-white" to "white" reenlistments would increase if the SRB payment method were to be changed to the lump sum method.

Finally, with the growing business of buying "future payment streams" booming in the United States, changing the payment plan to lump sum may prevent Marines from taking their SRB contract to these types of businesses and receiving a lump sum for them at a very high discounted rate.

### 2. Disadvantages of the Lump Sum Payment Method

A disadvantage of the lump sum payment method noted by the 1985 GAO study is that it may reduce the incentive for reenlistees to complete their initial contract. Cylke et al. define this potential to default on one's contract as a "moral hazard." [Ref 5: p 16] However, Cylke.et al. examined the historical survival rate of Navy personnel during the installment period prior to 1979 and found that it was nearly 98 percent. They concluded that the "moral hazard" issue was not an important factor. [Ref 5: p 19]

Another disadvantage noted by the GAO and by Marine Corps manpower planners is that paying SRBs in lump sum amounts makes the bonus less visible to the

service member over the entire length of the contract period. Thus, a service member may take the bonus but by the third or fourth year may not remember the benefits he/she gleaned from the bonus.

A disadvantage for the government of changing the SRB payment method to lump sum is that the current SRB budget would have to be increased to cover the new payment method. This is because the government would have to continue paying the SRBs it is obligated to make while paying 100 percent of the "lump sum method" SRB in the transition year. The first year of change would incur the largest budget increase with each additional year after the transition becoming less costly. Approximately four years after the payment method change, all the past SRB obligations would be paid off and the SRB budget would be the same as it is today (in constant dollars).

A final disadvantage of paying SRBs in lump sum is that the money may not be spent wisely by the Marine. In other words, the Marine may "blow" the cash on a trip to Las Vegas or as a down payment on a car that he/she cannot afford. It was reported in the Wall Street Journal that many civilian retirees are selecting the option to receive their retirement in a lump sum amount and then spending it unwisely. "They bought boats, houses, trailers, trucks, guns, furniture, fishing gear and satellite dishes . . . Financial advisors say they have seen people use retirement money to fix the roof, pay for children's weddings and go to Las Vegas . . . Younger employees were the likeliest to spend every dime." [Ref 21: p A1] Of course, a counter argument is that the USMC should not be in the business of telling its members how to spend their paychecks. Note that under the current SRB method Marines may very well spend the 50 percent upfront payment unwisely.

## F. CHAPTER SUMMARY

This chapter has provided a historical perspective on net present value, the personal discount rate, observed differences of PDR between demographic groups, the types of studies used to determine PDRs, and the advantages and disadvantages of switching to a lump sum SRB payment method. The PDR among demographic groups was found to be significantly higher (approximately 5 percent) for non-whites than whites making the current SRB payment method less appealing to non-whites than whites. Implicit rate studies were determined to be the most accurate predictors of a "group's" PDR if the context of the natural experiment closely resembles the group of interest. Two implicit PDR studies matched this requirement. Cylke et al. studied a natural experiment when the SRB payment method was changed temporally to lump sum. Warner and Pleeter studied the decisions of military personnel on whether to take a lump sum or annuity-based early separation package during the draw-down era in the early 1990's. Based on this literature review, the author adopted a reasonable nominal PDR range for Zone A Marines of between 21 percent and 41 percent with an "expected" nominal PDR of 31 percent.

THIS PAGE INTENTIONALLY LEFT BLANK

# IV. ESTIMATES OF EFFECT OF LUMP SUM SRB ON REENLISTMENT RATES

## A. METHODOLOGY

### 1. Review of PDR Estimates

In the previous chapter, it was determined from the literature review that an accurate "range" of expected personal discount rates (PDRs) for the Marine Corps' Zone A eligible Marines is between 21 percent and 41 percent with a mean rate of 31 percent. These alternative PDRs will be used in this chapter to analyze the effects of changing the SRB payment method to lump sum.

### 2. Review of USMC SRB Planning / Budgeting Process

The Marine Corps basis its SRB budget and retention estimates on historical reenlistment data held by Marine Corps planners and a 1994 Center for Naval Analysis study by Dr. James H. North. [Ref 8] Dr. North studied the cost effectiveness of the SRB and lateral moves from one Marine Occupational Specialty (MOS) to another MOS. In order to accomplish this, he had to analyze the effects of the SRB on retention behavior.

Dr. North estimated the probability of reenlistment as a function of the SRB multiple, the contract length, the Marine's occupational field, a pay index, and the civilian unemployment rate. [Ref 22: p 26] The pay index and economic factors (unemployment rate) used in Dr. North's model are updated every two years by the Center for Naval Analysis and applied by Marine Corps SRB planners in setting the SRB multiples to offer Marines.

Military pay raises are historically given on an annual basis and become effective on the first day of January. Although the entire pay raise for a given year occurs on one

day, it has been assumed by Dr. North that the effects of a pay raise do not all occur on this single day. This is because information regarding the pay raise normally makes it out to the military members far in advance of the effective pay raise date. Dr. North's pay index uses average changes in the military's pay table and normalizes the "annual" pay increase experienced by military personnel (on 1 January) to reflect monthly pay raises, which are then compared to pay raises in the civilian labor market. For civilian earnings, he uses quarterly data provided by the U.S. Bureau of Labor Statistics to reflect the opportunities available to 20- to 24-year old males. The time span of the data used in his 1994 study was from 1987 through 1992. After adjusting the data for non-applicable items (such as out-year reenlisting that is not an offered option today), Dr. North's data set consisted of 40,984 observations over the 1987 – 1992 time period. [Ref 22: p 21] The functional form of Dr. North's model was a nonlinear logit specification. The specification which fit the data the best was "one that included separate Occupational Field variables without an interaction with the SRB multiple." [Ref 22: p 27]

Dr. North's pay index is updated every other year by the Center for Naval Analysis and provided to Marine Corps manpower planners. The author compared the FY 2000 update with those of FY 1996 and FY 1998. The 1996 and 1998 updates had almost identical predicted reenlistment rates. The FY 1998 estimates predicted that retention would increase by an average of 0.9 percent as compared to FY 1996. The FY 2000 update predicted that retention levels would drop an average 5.1 percent. For comparison purposes, the FY 2000 retention estimates were subtracted from the FY 1998 estimates and the FY 1998 estimates were subtracted from the FY 1996 estimates. [Refs 23, 24, 25] Table 3 below compiles the results of this calculation.

| | Average | Median | Mode | Max | Min | Std Dev |
|---|---|---|---|---|---|---|
| FY 98 - FY 00 | 5.1% | 5.4% | 6.7% | 6.7% | 2.0% | 0.01374 |
| FY 96 - FY 98 | -0.9% | -0.9% | -0.7% | 0.7% | -3.9% | 0.00618 |

**Table 3 – Differences in Marine Corps-Wide Predicted Retention Using C.N.A. Retention Forecasts**

The Marine Corps uses these updates as a basis for setting up its First-Term Alignment Plan (FTAP). The FTAP determines how many Marines the Marine Corps will need to bring into the "career force." Career force is defined here as those Marines who have greater than four years of service. The FTAP sets the bonus multiples in each MOS to help incentivize Marines to reenlist in areas that are expected to experience manning shortfalls. The annual update of Occupational Field retention estimates is also used as justification for the Marine Corps SRB budget request to Congress. The fiscal year 2000 Center for Naval Analysis predicted reenlistment rates for each Marine Occupational Field are shown below in Table 4. [Ref 23: p 3]

| OCC | SRB Levels | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 |
| 01 | 35.1% | 44.0% | 53.3% | 62.4% | 70.7% | 77.8% |
| 02 | 8.5% | 12.0% | 16.5% | 22.3% | 29.4% | 37.7% |
| 03 | 8.3% | 11.6% | 16.0% | 21.7% | 28.7% | 37.0% |
| 04 | 14.2% | 19.4% | 26.0% | 33.8% | 42.6% | 51.9% |
| 08 | 10.6% | 14.7% | 20.0% | 26.6% | 34.6% | 43.4% |
| 11 | 9.9% | 13.8% | 18.9% | 25.3% | 33.0% | 41.7% |
| 13 | 11.2% | 15.6% | 21.1% | 28.0% | 36.1% | 45.1% |
| 15 | 36.4% | 45.4% | 54.8% | 63.8% | 71.9% | 78.8% |
| 18 | 9.5% | 13.2% | 18.1% | 24.4% | 31.9% | 40.5% |
| 21 | 11.9% | 16.4% | 22.2% | 29.3% | 37.6% | 46.7% |
| 23 | 8.3% | 11.6% | 16.1% | 21.8% | 28.8% | 37.0% |
| 25 | 19.1% | 25.6% | 33.3% | 42.1% | 51.4% | 60.6% |
| 26 | 7.9% | 11.1% | 15.3% | 20.9% | 27.7% | 35.8% |
| 28 | 8.5% | 11.9% | 16.4% | 22.2% | 29.3% | 37.5% |
| 30 | 24.7% | 32.3% | 40.9% | 50.2% | 59.4% | 68.0% |
| 31 | 34.4% | 43.2% | 52.5% | 61.7% | 70.0% | 77.3% |
| 33 | 17.0% | 23.0% | 30.3% | 38.7% | 47.8% | 57.1% |
| 34 | 19.7% | 26.3% | 34.2% | 43.0% | 52.3% | 61.5% |
| 35 | 10.9% | 15.1% | 20.6% | 27.3% | 35.3% | 44.3% |
| 40 | 12.7% | 17.5% | 23.5% | 30.9% | 39.4% | 48.6% |
| 41 | 63.6% | 71.8% | 78.7% | 84.3% | 88.6% | 91.9% |
| 43 | 7.0% | 9.9% | 13.7% | 18.8% | 25.1% | 32.8% |
| 44 | 18.6% | 25.0% | 32.6% | 41.3% | 50.6% | 59.8% |
| 46 | 18.0% | 24.2% | 31.7% | 40.3% | 49.5% | 58.7% |
| 55 | 25.9% | 33.7% | 42.5% | 51.8% | 60.9% | 69.4% |
| 57 | 13.4% | 18.3% | 24.6% | 32.1% | 40.8% | 50.0% |
| 58 | 9.8% | 13.6% | 18.6% | 25.0% | 32.6% | 41.3% |
| 59 | 9.0% | 12.5% | 17.2% | 23.2% | 30.6% | 39.0% |
| 60 | 10.6% | 14.7% | 20.1% | 26.8% | 34.7% | 43.6% |
| 61 | 11.2% | 15.4% | 21.0% | 27.9% | 35.9% | 44.9% |
| 63 | 8.9% | 12.4% | 17.1% | 23.1% | 30.4% | 38.8% |
| 64 | 9.5% | 13.3% | 18.2% | 24.4% | 31.9% | 40.5% |
| 65 | 12.2% | 16.9% | 22.8% | 30.0% | 38.4% | 47.5% |
| 66 | 24.7% | 32.3% | 40.9% | 50.2% | 59.4% | 68.0% |
| 68 | 11.9% | 16.5% | 22.3% | 29.4% | 37.7% | 46.8% |
| 70 | 18.1% | 24.3% | 31.8% | 40.4% | 49.6% | 58.8% |
| 72 | 10.6% | 14.7% | 20.0% | 26.6% | 34.6% | 43.4% |
| 73 | 7.2% | 10.1% | 14.1% | 19.2% | 25.7% | 33.5% |
| 9919 | 12.7% | 17.5% | 23.5% | 30.9% | 39.4% | 48.6% |

**Table 4. Center for Naval Analysis FY 2000 Predicted Reenlistment Rates by SRB Multiple and Occupational Field [Ref 23: p 3]**

The validity of CNA's predicted reenlistment rates has been hard to establish because of the inherent flexibility required by Marine planners during the fiscal year. Bonus multiples often change quarterly. The current manpower policy is to offer the highest bonus multiple during the first quarter of the fiscal year and reduce the SRB multiple as Occupational Fields start to fill up. This policy is followed to reduce the potential for Marines to "game" the system by holding out for a better multiple. Because multiples are in a constant state of change, tracking the outcome of any given Occupational Field is difficult at best. Appendix A lists the title of each Occupational Field used in this thesis.

### 3. Methodology for Analyzing SRB Payment Methods

This thesis is interested in the effects of changing the Selective Reenlistment Bonus (SRB) payment method to lump sum. To do this, I obtained the current number of Marines eligible/available for reenlistment (by Occupational Field (OF)) in FY 2000 from the Marine Corps Enlisted Career Planner. The Excel model uses the Center for Naval Analysis (CNA) retention estimates (in Table 4 above) to determine the "additional" number of Marines each bonus multiple will retain using the current SRB payment method and the current "eligible" pool of Marines in each OF. This is the "marginal effect" of each increase in the bonus multiple. The model assumes the reenlistee is a Corporal (E-4) with over four years of service and a contract reenlistment length of four years. Using the January 2000 pay tables the base monthly pay of this reenlistee is $1,497.30. [Ref 26] Selective Reenlistment Bonus is paid by multiplying base pay times length of contract times a SRB multiple of one through five. [Ref 27: p 3] Table 5 shows the value of the SRB contract for values of the SRB multiple using the

hypothetical Marine. The Excel model has been programmed to incorporate future changes in the estimated retention (rates for each SRB multiple) and pay in a single "user input" worksheet.

| Value of SRB Contract | |
|---|---|
| Multiple | $ Value |
| 1 | 5,989 |
| 2 | 11,978 |
| 3 | 17,968 |
| 4 | 23,957 |
| 5 | 29,946 |

**Table 5 – SRB Contract Values by Multiple for Hypothetical Marine**

The model then determines the net present value (NPV) of each SRB multiple using a personal discount rate (PDR) entered by the analyst. In this analysis, PDRs of 21 percent, 31 percent, and 41 percent will be used and compared under the current SRB payment method. The model then determines the marginal effect on retention for every $1,000 of NPV for each SRB multiple. It then takes the "delta" between the NPVs of the current SRB payment method and the proposed lump sum SRB payment method and multiplies this "delta" by the marginal effect (ME) per $1,000 of NPV calculated above. This produces an estimation of the change in the number of Marines who would reenlist should the payment method be changed. Mathematically, the model makes the following calculations:

$$\frac{\$NPV}{\text{Marginal Effect Retention Increase per SRB Multiple}} = \frac{\$1,000}{X}$$

Where "X" equals the marginal increase in retention (measured in "bodies" for every $1,000 of NPV paid

$$X = \frac{\$1{,}000 * (\text{Marginal Effect Retention Increase per SRB Multiple})}{\$NPV}$$

$$\text{Increase in Retention per Lum Sum SRB} = \frac{\text{Delta in Payment Method NPV} * X}{\$1{,}000}$$

### 4. Possible Model Outputs

This model has an unlimited number of outputs it could produce. It can display the marginal retention effects of changing SRB payments to lump sum for each 1-unit change in the SRB multiple for each occupational field. This data, however, would take the reader a very long time to sort through and would not really apply to the Marine Corps' actual manpower planning process. Therefore, I have chosen for this application to use the actual FY 2000 SRB multiples that have been adopted and estimated the change in retention levels that would occur in 2000 if the SRB payment method were switched to lump sum. This means that if the Marine Corps is paying a "zero" multiple, no change will be noted in retention levels. The analysis is done by OF and the net gains will be applicable to today's (FY 2000) SRB program. The next section discusses the results of the "range" of PDRs used in this analysis.

## B. RESULTS

### 1. Change in Predicted Retention From Using Lump Sum Method

The Excel model was run using estimated personal discount rates of 21, 31, and 41 percent. The three runs are shown below in tables 6, 7, and 8, respectively.

| (1) OccFld | (2) Proposed SRB Multiple [a] | (3) Contract Amount [b] ($) | (4) Forecast Retention-Current Payment Method | (5) Forecast Retention-Lump sum Payment Method | (6) Net Gain from Lump Sum Method = (5) – (4) |
|---|---|---|---|---|---|
| 01 | 0 | 0 | 465 | 465 | 0 |
| 02 | 4 | 23,957 | 147 | 166 | 19 |
| 03 | 1 | 5,989 | 614 | 646 | 32 |
| 04 | 2 | 11,978 | 123 | 133 | 10 |
| 08 | 4 | 23,957 | 215 | 242 | 27 |
| 11 | 1 | 5,989 | 64 | 67 | 3 |
| 13 | 0 | 0 | 142 | 142 | 0 |
| 15 | 0 | 0 | 36 | 36 | 0 |
| 18 | 1 | 5,989 | 54 | 57 | 3 |
| 21 | 2 | 11,978 | 130 | 141 | 11 |
| 23 | 1 | 5,989 | 27 | 29 | 1 |
| 25 | 1 | 5,989 | 384 | 402 | 18 |
| 26 | 4 | 23,957 | 65 | 73 | 8 |
| 28 | 5 | 29,946 | 222 | 253 | 31 |
| 30 | 0 | 0 | 271 | 271 | 0 |
| 31 | 0 | 0 | 38 | 38 | 0 |
| 33 | 0 | 0 | 87 | 87 | 0 |
| 34 | 3 | 17,968 | 78 | 86 | 8 |
| 35 | 0 | 0 | 250 | 250 | 0 |
| 40 | 5 | 29,946 | 121 | 137 | 16 |
| 41 | 0 | 0 | 1 | 1 | 0 |
| 43 | 5 | 29,946 | 13 | 15 | 2 |
| 44 | 0 | 0 | 14 | 14 | 0 |
| 46 | 0 | 0 | 16 | 16 | 0 |
| 55 | 0 | 0 | 36 | 36 | 0 |
| 57 | 2 | 11,978 | 28 | 30 | 2 |
| 58 | 1 | 5,989 | 89 | 93 | 5 |
| 59 | 4 | 23,957 | 37 | 41 | 5 |
| 60 | 5 | 29,946 | 371 | 423 | 51 |
| 61 | 4 | 23,957 | 176 | 198 | 22 |
| 63 | 4 | 23,957 | 125 | 141 | 16 |
| 64 | 4 | 23,957 | 137 | 154 | 17 |
| 65 | 2 | 11,978 | 75 | 81 | 6 |
| 66 | 0 | 0 | 65 | 65 | 0 |
| 68 | 4 | 23,957 | 18 | 20 | 2 |
| 70 | 1 | 5,989 | 90 | 94 | 4 |
| 72 | 4 | 23,957 | 84 | 95 | 11 |
| 73 | 5 | 29,946 | 6 | 7 | 1 |
| 9919 | 5 | 29,946 | 10 | 11 | 1 |
| Total | | | 4926 | 5260 | 335 |

**Table 6. Effects of Lump Sum SRB on Retention using a 21 Percent Personal Discount Rate**

*a* This column provides the SRB multiple proposed by MPP-20 for each Occupation Field in FY 2000. [Ref 8]

*b* Value of SRB Multiple for the 'average' reenlistee.

| (1) OccFld | (2) Proposed SRB Multiple [a] | (3) Contract Amount [b] ($) | (4) Forecast Retention-Current Payment Method | (5) Forecast Retention-Lump sum Payment Method | (6) Net Gain from Lump Sum Method = (6) – (5) |
|---|---|---|---|---|---|
| 01 | 0 | 0 | 465 | 465 | 0 |
| 02 | 4 | 23,957 | 147 | 173 | 26 |
| 03 | 1 | 5,989 | 614 | 658 | 44 |
| 04 | 2 | 11,978 | 123 | 137 | 14 |
| 08 | 4 | 23,957 | 215 | 253 | 38 |
| 11 | 1 | 5,989 | 64 | 69 | 5 |
| 13 | 0 | 0 | 142 | 142 | 0 |
| 15 | 0 | 0 | 36 | 36 | 0 |
| 18 | 1 | 5,989 | 54 | 58 | 4 |
| 21 | 2 | 11,978 | 130 | 145 | 15 |
| 23 | 1 | 5,989 | 27 | 29 | 2 |
| 25 | 1 | 5,989 | 384 | 408 | 25 |
| 26 | 4 | 23,957 | 65 | 77 | 12 |
| 28 | 5 | 29,946 | 222 | 265 | 43 |
| 30 | 0 | 0 | 271 | 271 | 0 |
| 31 | 0 | 0 | 38 | 38 | 0 |
| 33 | 0 | 0 | 87 | 87 | 0 |
| 34 | 3 | 17,968 | 78 | 89 | 11 |
| 35 | 0 | 0 | 250 | 250 | 0 |
| 40 | 5 | 29,946 | 121 | 143 | 22 |
| 41 | 0 | 0 | 1 | 1 | 0 |
| 43 | 5 | 29,946 | 13 | 15 | 3 |
| 44 | 0 | 0 | 14 | 14 | 0 |
| 46 | 0 | 0 | 16 | 16 | 0 |
| 55 | 0 | 0 | 36 | 36 | 0 |
| 57 | 2 | 11,978 | 28 | 31 | 3 |
| 58 | 1 | 5,989 | 89 | 95 | 6 |
| 59 | 4 | 23,957 | 37 | 43 | 7 |
| 60 | 5 | 29,946 | 371 | 442 | 71 |
| 61 | 4 | 23,957 | 176 | 207 | 31 |
| 63 | 4 | 23,957 | 125 | 147 | 22 |
| 64 | 4 | 23,957 | 137 | 161 | 24 |
| 65 | 2 | 11,978 | 75 | 84 | 9 |
| 66 | 0 | 0 | 65 | 65 | 0 |
| 68 | 4 | 23,957 | 18 | 21 | 3 |
| 70 | 1 | 5,989 | 90 | 96 | 6 |
| 72 | 4 | 23,957 | 84 | 99 | 15 |
| 73 | 5 | 29,946 | 6 | 8 | 1 |
| 9919 | 5 | 29,946 | 10 | 12 | 2 |
| Total | | | 4926 | 5388 | 463 |

**Table 7. Effects of Lump Sum SRB on Retention using a 31 Percent Personal Discount Rate**

*a* This column provides the SRB multiple proposed by MPP-20 for each Occupation Field in FY 2000. [Ref 8]

*b* Value of SRB Multiple for the 'average' reenlistee.

| (1) OccFld | (2) Proposed SRB Multiple [a] | (3) Contract Amount [b] ($) | (4) Forecast Retention-Current Payment Method | (5) Forecast Retention-Lump sum Payment Method | (6) Net Gain from Lump Sum Method = (5) – (4) |
|---|---|---|---|---|---|
| 01 | 0 | 0 | 465 | 465 | 0 |
| 02 | 4 | 23,957 | 147 | 179 | 33 |
| 03 | 1 | 5,989 | 614 | 669 | 55 |
| 04 | 2 | 11,978 | 123 | 141 | 18 |
| 08 | 4 | 23,957 | 215 | 262 | 47 |
| 11 | 1 | 5,989 | 64 | 70 | 6 |
| 13 | 0 | 0 | 142 | 142 | 0 |
| 15 | 0 | 0 | 36 | 36 | 0 |
| 18 | 1 | 5,989 | 54 | 59 | 5 |
| 21 | 2 | 11,978 | 130 | 149 | 19 |
| 23 | 1 | 5,989 | 27 | 30 | 2 |
| 25 | 1 | 5,989 | 384 | 414 | 31 |
| 26 | 4 | 23,957 | 65 | 79 | 15 |
| 28 | 5 | 29,946 | 222 | 276 | 54 |
| 30 | 0 | 0 | 271 | 271 | 0 |
| 31 | 0 | 0 | 38 | 38 | 0 |
| 33 | 0 | 0 | 87 | 87 | 0 |
| 34 | 3 | 17,968 | 78 | 92 | 13 |
| 35 | 0 | 0 | 250 | 250 | 0 |
| 40 | 5 | 29,946 | 121 | 148 | 28 |
| 41 | 0 | 0 | 1 | 1 | 0 |
| 43 | 5 | 29,946 | 13 | 16 | 3 |
| 44 | 0 | 0 | 14 | 14 | 0 |
| 46 | 0 | 0 | 16 | 16 | 0 |
| 55 | 0 | 0 | 36 | 36 | 0 |
| 57 | 2 | 11,978 | 28 | 32 | 4 |
| 58 | 1 | 5,989 | 89 | 97 | 8 |
| 59 | 4 | 23,957 | 37 | 45 | 8 |
| 60 | 5 | 29,946 | 371 | 460 | 88 |
| 61 | 4 | 23,957 | 176 | 214 | 38 |
| 63 | 4 | 23,957 | 125 | 152 | 28 |
| 64 | 4 | 23,957 | 137 | 167 | 30 |
| 65 | 2 | 11,978 | 75 | 86 | 11 |
| 66 | 0 | 0 | 65 | 65 | 0 |
| 68 | 4 | 23,957 | 18 | 22 | 4 |
| 70 | 1 | 5,989 | 90 | 97 | 7 |
| 72 | 4 | 23,957 | 84 | 102 | 18 |
| 73 | 5 | 29,946 | 6 | 8 | 2 |
| 9919 | 5 | 29,946 | 10 | 12 | 2 |
| Total | | | 4926 | 5500 | 574 |

**Table 8. Effects of Lump Sum SRB on Retention using a 41 Percent Personal Discount Rate[a]**

*a*. This column provides the SRB multiple proposed by MPP-20 for each Occupation Field in FY 2000. [Ref 8]

*b* Value of SRB Multiple for the 'average' reenlistee.

The analysis indicates that the Marine Corps has the potential to increase Zone A reenlistments by between 6.8, 9.4, or 11.7 percent (overall) by changing the SRB payment method to lump sum (depending on PDR). This change would require no increase in the SRB budget in the long term (after four years). This equates to 335 additional Marines using a 21 percent PDR, 463 additional Marines using a 31 percent PDR, and 574 additional Marines using a 41 percent PDR. The increase would not "fix" the shortfalls occurring in FY 2000, however; they would greatly reduce the retention problem for the Corps. The four Marine Occupational Fields that are estimated to benefit the most from changing the SRB payment method (for PDRs of 21, 31, and 41 percent) are; Fixed Wing Aircraft Maintenance (51,71,88), Infantry (32,44,55), Data Communications Maintenance (31,43,54), and Field Artillery (27,38,47). These fields are either combat arms or require a lot of technical training and have high civilian employment opportunities.

### 2. Change in Predicted Retention Holding Reenlistment Requirement Constant

Another way to view the benefit from changing the SRB payment method to lump sum is that the SRB bonus payments can be reduced while still obtaining the required number of reenlisting Marines. The outcome of this would be to lower the cost associated with reducing the SRB budget. There are many problems associated with doing this using an Excel spreadsheet, such as some Occupation Fields (OF) may be over-staffed while others are under-staffed even though the "total" reenlistment number may look fine. The author attempted to use the built-in Excel "solver" program but the calculation exceeded the "solver" program's capabilities. It is possible that this problem

could be solved by inputting the data in a more powerful, non-PC based program, but time does not allow for this action in this thesis.

One suggestion, offered by a Professor of the Naval Postgraduate School Operations Research Department was to simply reduce each offered FY 2000 SRB multiple by one and to see what happened. One drawback of this method is that many of the SRB multiples offered by the Marine Corps in FY 2000 are set at one. By reducing the multiple from one to zero, there will be no effect of changing the payment method because no payment would be made at all. With this in mind, I reduced all FY 2000 SRB multiples by one and ran the model using 21 percent, 31 percent, and 41 percent personal discount rates. I then compared the retention estimates predicted by these "reduced" multiples to the current payment method "requirement" number of 4,926 reenlistments into the career force. The results are shown below in Table 9.

| Required Reenlistments | PDR | FY 2000, SRB Multiple - 1 reenlistments | Shortfall |
|---|---|---|---|
| 4,926 | 21% | 4,247 | 679 |
| 4,926 | 31% | 4,315 | 611 |
| 4,926 | 41% | 4,374 | 552 |

**Table 9 – Effects of Changing the SRB Payment Method to Lump Sum and Reducing the FY 2000 SRB Multiples by One.**

As the reader can see, an across-the-board SRB multiple reduction using the highest PDR still leaves Marine Corps manning levels below requirements. It could be assumed, however, that some Occupation Fields could have their SRB multiples reduced while still achieving the desired outcome. This simulation is recommended for a follow-on effort.

### 3. Annualized Cost of Leaving (ACOL) Model Comparison

Dr. Pat Mackin from SAG Corporation in Falls Church, Virginia, provided the ACOL model used in this thesis. It is a Microsoft Excel-based model that incorporates all the aspects of ACOL discussed in chapter two of this thesis. It allows the operator to adjust inflation rates (allowing for real or nominal PDRs to be used), personal discount rates, length of service at the decision point, and payment method type (lump sum or current method). The SAG Corporation's ACOL model also allows the user to change demographic characteristics such as gender, race, age, dependent status, and education. Although the model has been updated as recently as this year, the model depends on data produced in 1988. Therefore, the ACOL spreadsheet produces figures (values) that are deflated to reflect 1988 "constant" dollars.

The ACOL model maintained by SAG Corporation was also designed to be used for personal discount rates of around 10 percent. The original ACOL analysis determined real discount rates of around 10 percent at the time of the ACOL model's programming. Dr. Mackin cautioned the author that the coefficients used in ACOL are not really appropriate for a discount rate much higher than 10 percent. However, the author believes the importance of running the ACOL model for this thesis is not the determination of an "accurate" ACOL value to use in policy analysis, but to determine how ACOL values are affected by changing the SRB payment method to lump sum.

I have chosen to run the ACOL model on a white, 23-year old male with a high school education at the first term reenlistment point (four years of service). There will be a total of 36 ACOL model runs; SRB bonus multiples of zero through five will be run using PDRs of 21 percent, 31 percent, and 41 percent and both the current and proposed

lump sum payment methods will be compared. Table 10 below presents the value of the ACOL for these various options.

| | Selective Reenlistment Bonus Multiple | | | | | |
|---|---|---|---|---|---|---|
| Personal Discount Rate | 0 | 1 | 2 | 3 | 4 | 5 |
| 21 percent current method | $ 9,527 | $10,718 | $12,227 | $13,769 | $15,312 | $16,855 |
| 21 percent lump sum | $ 9,527 | $11,144 | $13,146 | $15,149 | $17,152 | $19,155 |
| 31 percent current method | $ 7,968 | $ 9,667 | $11,457 | $13,254 | $15,051 | $16,849 |
| 31 percent lump sum | $ 7,968 | $10,374 | $12,885 | $15,397 | $17,908 | $20,420 |
| 41 percent current method | $ 6,730 | $ 8,729 | $10,797 | $12,865 | $14,933 | $17,001 |
| 41 percent lump sum | $ 6,730 | $ 9,714 | $12,767 | $15,820 | $18,873 | $21,926 |

**Table 10 – ACOL Values for: Current vs. Lump Sum SRB Payment Methods**

The ACOL runs show that lump sum SRB payments consistently produce a higher ACOL for young naval service-members than the current SRB payment plan. Of note about these results is that some ACOL values actually increase with a higher personal discount rate (see lump sum multiples of 3 – 5 and current method multiple 5). This can be attributed to using the last step of the ACOL model calculation that divides the calculated ACOL value up to that point by the "annualizing" factor. The larger the discount rate, the smaller this value is for a given horizon, making it difficult to compare ACOL values across discount rates. [Ref 28]

The ACOL model can be manipulated by manually inputting a value of $1,000 into the "baseline" ACOL for a sailor who has four years of service into the "ACOL

Values and Econometric Coefficients" worksheet of the model. The next manipulation is to enter a value of $2,000 into the "new" ACOL column for four years of service. Switching to the "continuation rate" worksheet, the ACOL model predicts a 2.63 percent increase in all-Navy SRB-targeted continuation rates per every $1,000 of ACOL value increase. By dividing 2.63 percent by $1,000, an all-Navy continuation rate increase of .0000263 for every one dollar increase in ACOL is calculated.

By changing the SRB payment from its current method to a lump sum produces an increase in net present value and thus increases the value of the cost-of-leaving. This increase is $2,300 using a 21 percent PDR, $3,571 for a 31 percent PDR, and $4,925 for a 41 percent PDR. These increases in the cost-of-leaving generate predicted increases in all-Navy retention of 6.0 percent, 9.4 percent, and 12.9 percent, respectively, for discount rates of 21, 31, and 41 percent.

| Increase in Reenlistment rate (in %) | | |
|---|---|---|
| PDR | Using USMC Data | Using Navy ACOL Model |
| 0.21 | 6.80 | 6.00 |
| 0.31 | 9.39 | 9.37 |
| 0.41 | 11.65 | 12.85 |

**Table 11 – USMC Data / ACOL Model Comparison**

As Table 11 shows, the predicted increases in reenlistment rates using the all-Navy ACOL are very close in magnitude to the all-USMC increases obtained using the Marine Corps data. This similarity between the results using the two approaches might appear surprising. However, it should be pointed out that the CNA model that produces the predicted retention rates (for each bonus multiple) is actually a variant of an ACOL-type model. [Ref 22] For example, CNA's model includes a variable on the military-

civilian pay differential, which is a key factor in the ACOL model. Thus, the similarity in the results is not unexpected.

## C. CHAPTER SUMMARY

This chapter discussed the methodology used in estimating the net manpower effects for the Marine Corps of changing the SRB payment method to lump sum. Using the FY 2000 SRB multiples the results show an increase in retention of between 335 and 574 Marines. This resulted in a net increase in retention of between 6.8 and 11.7 percent. It was determined that studying the possibility of keeping retention levels constant but reducing the SRB was too complex of an option to study for this thesis. Finally, the Navy's ACOL model estimated an increase in the ACOL value for PDRs of 21 percent, 31 percent, and 41 percent as an effect of changing the SRB payment method to lump sum. The estimated effects on retention of the ACOL value increases are estimated to be between 6.0 and 12.9 percent across all targeted Navy Occupation Fields.

The results of the well-established ACOL model reinforce the estimates produced by the spreadsheet analysis using the CNA retention estimates for FY 2000. The similarities in predicted increases in retention are most likely due to the fact that both the ACOL model and the CNA estimates use similar data (unemployment rates, civilian wage earnings) in their calculation.

# V. MONTE CARLO SIMULATION OF PERSONAL DISCOUNT RATES AND USMC RETENTION ELASTICITIES (BY USMC OCCUPATIONAL FIELD)

## A. MONTE CARLO SIMULATION

The analysis in chapter IV provided the reader with a best guess of what might happen should the SRB payment method be changed to lump sum. However, it only provided a "what if" analysis for three different personal discount rates and it adopted the continuation rates forecast by the Center for Naval Analysis. Indeed, these assumptions cannot be taken as totally accurate; there is a degree of uncertainty surrounding both the correct PDR and the retention forecast.

A notorious example of a similar prediction is that of a "drunk in the road." If we looked at a drunk's walk down the centerline of Interstate 95 while measuring and recording his every footstep, we could accurately say that on average the drunk walked on the centerline. If we used this analysis as a basis to "turn the drunk loose" on a walk down Interstate 95, however, realistically we would not expect to see him alive again. He would spend a lot of time to the left of centerline and perhaps a small amount of time far to the right of centerline.

Monte Carlo simulation was developed in the 1940s as a by-product of the Manhattan (Atomic Bomb) project. It involves feeding a large number of random inputs into a model and recording the outcomes of the random inputs. [Ref 29: p 18] Monte Carlo simulation is being used frequently today in areas of finance, accounting, logistics, marketing, risk management and strategy. Whenever there is room for uncertainty, Monte Carlo simulations allow for a better "understanding" of the overall picture.

## B. EXCEL BASED MONTE CARLO SIMULATON MODEL

### 1. How the Model Works

In the analysis of the proposed policy change to pay the Selective Reenlistment Bonus in a lump sum amount, there are two major "uncertain" model inputs: 1) The personal discount rate (PDR), and 2) The retention rate for each bonus multiple. In each Occupational Field, the number of additional Marines who will reenlist is computed by discounting the face value contract dollar amount back to today's dollars and determining how many Marines will reenlist for every $1,000 of NPV. It then multiples the difference between the face amount of the contract and the NPV of the contract times the computed reenlistment rate per $1,000 of NPV to estimate the number of additional Marines that will reenlist with a lump sum payment method. By allowing the PDR and the CNA retention estimates to become uncertain, we have an ideal situation to use the Monte Carlo simulation technique.

### 2. Model Methodology

The Monte Carlo analysis of the effects of changing the SRB payment method to lump sum in this thesis relies on the Excel add-on computer program "INSIGHT.XLA". It was created by Dr. Sam Savage of Stanford University. Using the "input interface" worksheet of the author's model, a future manpower planner can select a most likely PDR and SRB multiple retention forecast and vary the standard deviation around these estimates. The Insight Excel add-on command "gen_normal" creates a normal random distribution around these "best guess" estimates. If the operator of the model were certain of his input, he would select a standard deviation setting of "0" and the model would always generate the exact input value for the number being considered. This is

how the chapter four results were obtained. If the operator was fairly certain of his/her estimates for PDR and retention rates, they would input a standard deviation of "0.1". If the operator was very uncertain of his/her estimates for PDR and retention rates, they would put in a high standard deviation rate such as "2" or "3".

One problem specific to this model is that an individual cannot have a negative personal discount rate nor can there be negative retention rates. This would be equivalent to choosing the option to be paid less money in one year than today or having more Marines decide upon the civilian job option than you have in the Corps (negative reenlistment). The model therefore, does not allow for random generation of negative PDRs or retention rates. Thus, if PDR is varied about a mean of say 21 percent, the average PDR will increase above 21 percent as the variation increases. This is because the variation stops on the low side at zero, but has unlimited upside potential. Below is an example of increasing the standard deviation of the PDR (.1 - .5) about a mean PDR of 21 percent.

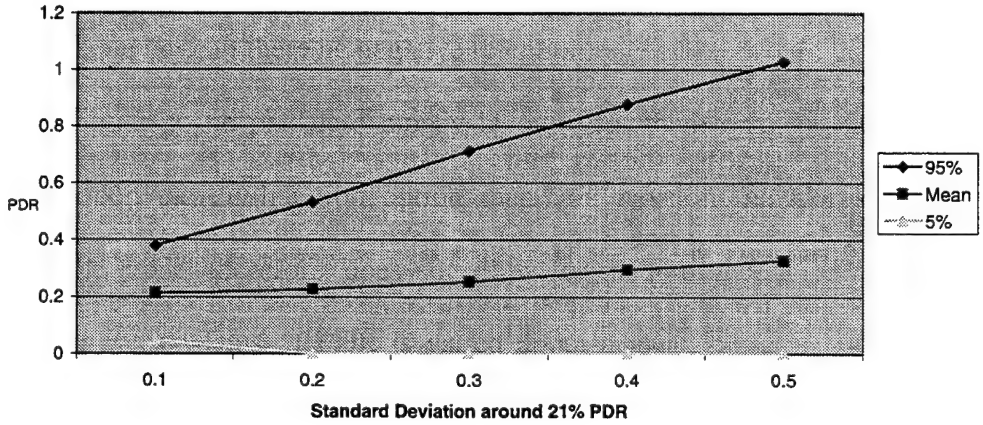


**Figure 1 – 95 Percent Confidence Interval of Randomly Generated Personal Discount Rate (PDR) Around a Mean PDR of 21 Percent using Increasing Standard Deviation Amounts**

Using a "0.4" standard deviation figure, one can see the upside PDR rate extends to almost 90 percent while the low side is "cemented" at 0 percent. This situation is not unique to this model, however, for investors use Monte Carlo simulation in analyzing stocks and options which all have more upside potential (unlimited) as compared to downside potential (can only decrease in value to zero). For this model, however, the constraining effects of not allowing for a negative PDR or a negative retention rate combined, have a large impact on the model's outcome.

The author ran a Monte Carlo simulation using 0.1 standard deviations around a PDR mean of 21 percent and around CNA's retention estimates and compared the current SRB payment method's retention to the lump sum payment method. Table 6 shows the retention estimates without introducing uncertainty. The current SRB payment method in this "constrained" case is only affected by the "uncertainty" surrounding the CNA retention estimate (because the current payment method does not rely on a NPV). However, the "average" expected retention levels for the current SRB payment method increased by 742 Marines because of the "non-negative" retention constraint imposed on CNA's estimates. Both the non-negative PDR constraint and the non-negative retention constraint affect the lump sum estimate. The lump sum "average" retention increased by 846 Marines using a 21 percent PDR. This "average increase would be greater if a larger PDR (31 percent) were used. A summary of the Monte Carlo simulation is in Table 12 below.

| Output Name | Current Method | Lump Sum Method |
|---|---|---|
| **Average** | 5667 | 6106 |
| **Std Dev** | 745 | 808 |
| **Std Err** | 23 | 25 |
| **Max** | 8322 | 9047 |
| **Min** | 3669 | 3998 |

**Table 12 – Monte Carlo Results of Retention Estimates using 21 Percent PDR and Standard Deviation of 0.1 around PDR and CNA Retention Estimates**

To introduce uncertainty into this thesis while still allowing the results to be meaningful, it was decided to reduce the standard deviations input into the model such that they would not be affected by the "non-negative" real world constraints. Several Monte Carlo simulations were run around a 21 percent personal discount rate to gain an understanding of the distributions being randomly generated in the model. Figure 2 below shows a simulation run around 21 percent using standard deviations of 0.01, 0.03, 0.05, 0.07, and 0.1.

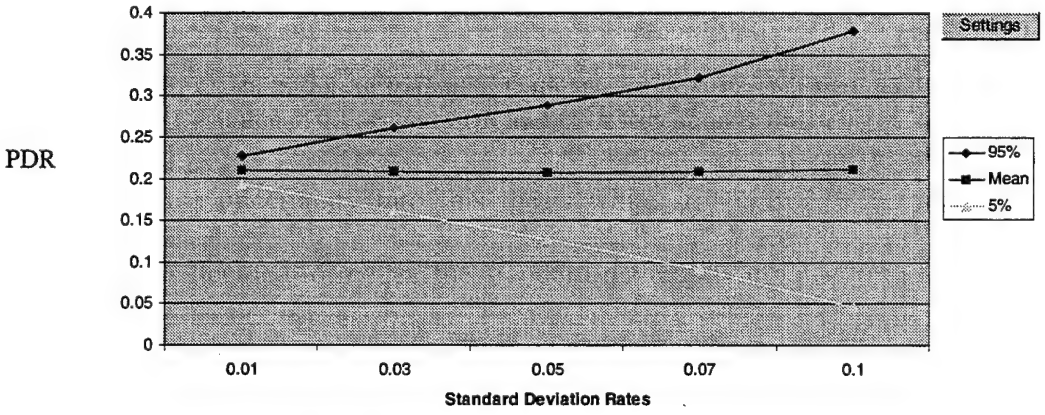


**Figure 2 – Insight.xla Standard Deviation Distribution Around 21 Percent**

The smallest personal discount rate used in this thesis was 21 percent which enables the input of a 0.1 standard deviation without going below zero (and thus forcing the "average" simulation PDR up). The CNA FY 2000 forecast retention increases were much smaller than 21 percent. There were a total of 195 CNA estimated marginal effect values for bonus multiples one through five and 39 Occupational Fields. They are plotted below in Figure 3 below.

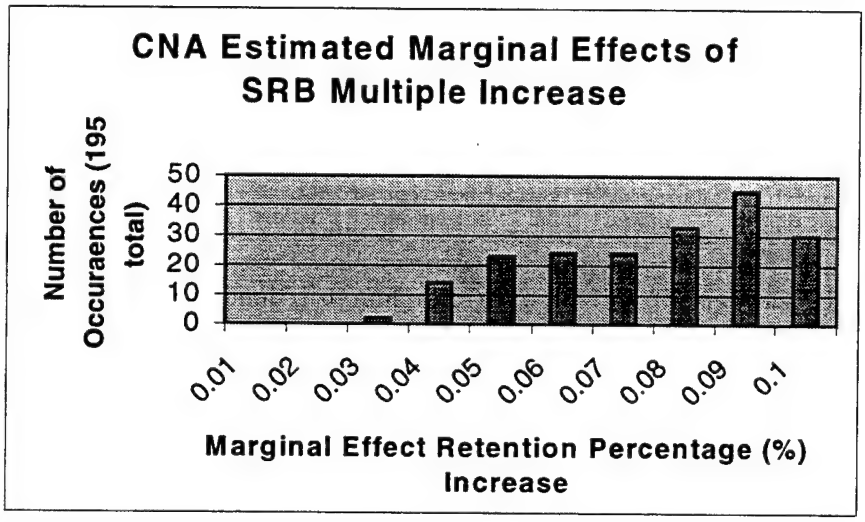


**Figure 3 – Frequency Distribution of FY 2000 CNA Estimated Marginal Effects of Increasing SRB Multiple for 39 Marine Occupational Fields**

Referring to Figure 2, a 0.03 standard deviation will result in an outcome of plus or minus 5 percent from the input value. Therefore, a maximum standard deviation for the retention effects for the Monte Carlo simulations was 0.03. By limiting the input standard deviation to 0.1 for PDR and 0.03 for C.N.A.'s FY 2000 retention estimates, the author feels he is losing some of the benefits gained by performing a Monte Carlo simulation. However, I feel this is a compromise between gaining "meaningful" results and the introduction of greater "uncertainty" into the analysis.

The model used in the analysis portion of this thesis is not "user friendly" enough at this point to be used by a Marine planner who is not very familiar with Excel spreadsheets and the Insight.xla add-on. However, the model has been programmed such that it can easily incorporate future policy changes, pay raises, retention estimate changes, and different estimates for PDR. It can be obtained by e-mailing the author at rossdl@hotmail.com

## C. RESULTS

As with the PDR range estimate portion of this thesis (chapter four), the number of scenarios possible using Monte Carlo simulation are unlimited. I chose to run three simulations using PDRs of 21 percent, 31 percent, and 41 percent and standard deviation inputs of 0.1 around the PDR and 0.03 around CNA's FY 2000 SRB multiple retention estimates. Each "run" consisted of 1,000 randomly generated "scenarios" where the PDR and the retention rates were allowed to change. The graphs and tables for the three personal discount rates are shown below in Figures 4 through 9 and Tables 13 through 15.

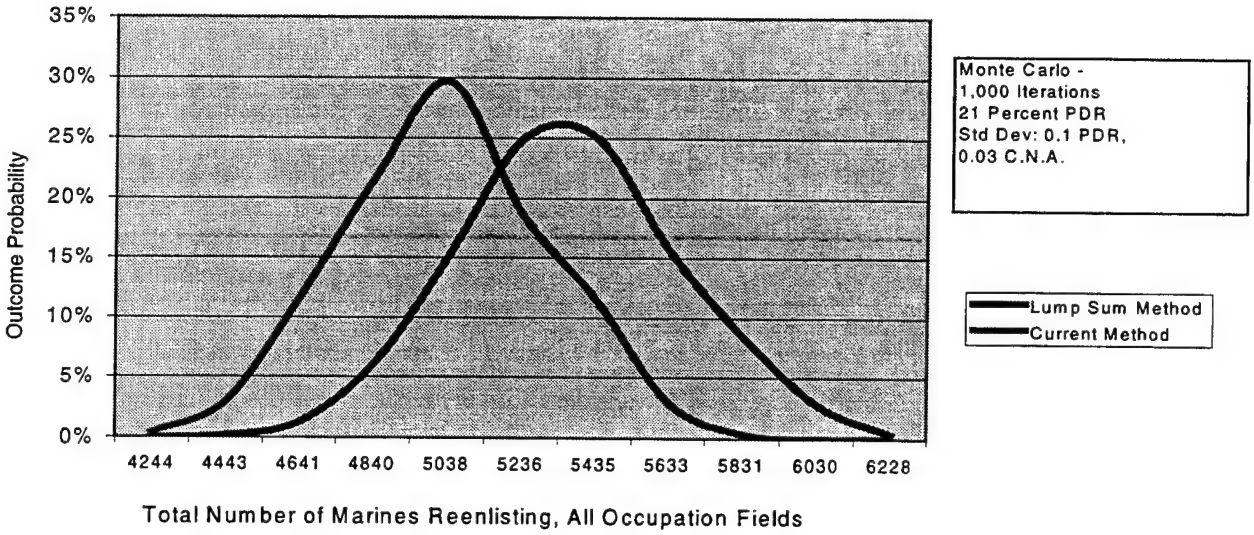


**Figure 4 – Common Histogram, Lump Sum vs. Current SRB Payment Method, 21 Percent PDR**

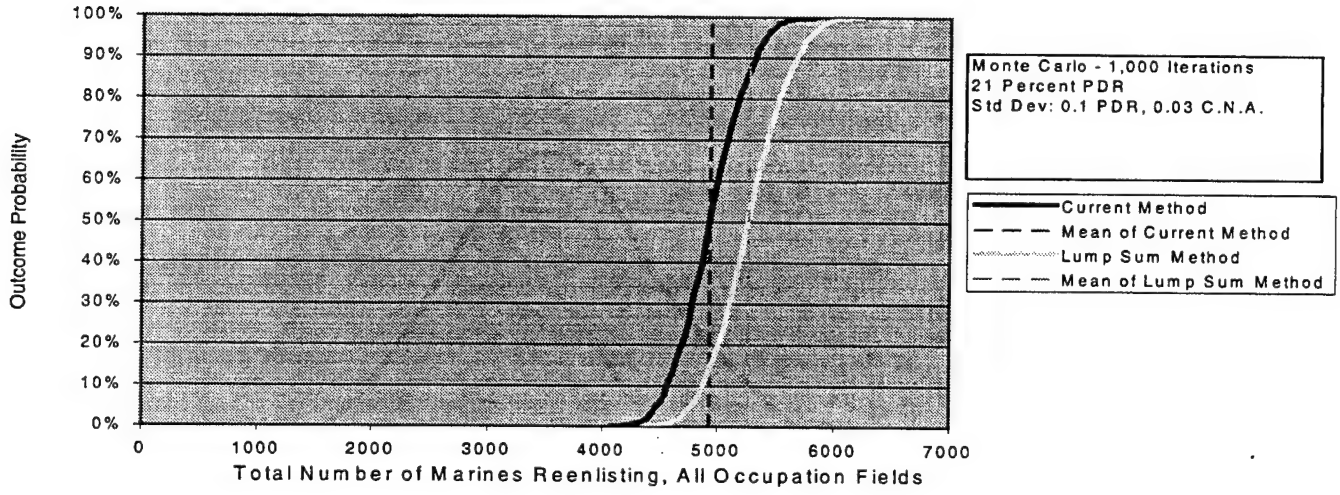


**Figure 5 – Common Cumulative, Lump Sum vs. Current Method SRB Payment Method, 21 Percent PDR**

| Output Name | Current Method | Lump Sum Method |
|---|---|---|
| **Average** | 4933 | 5261 |
| **Std Dev** | 276 | 299 |
| **Std Err** | 8.74 | 9.47 |
| **Max** | 5830 | 6228 |
| **Min** | 4046 | 4338 |

**Table 13 – Reenlistments, Lump Sum vs. Current Method SRB Payment Method, 21 Percent PDR with 0.1 PDR Standard Deviation and 0.03 C.N.A. FY 2000 Retention Estimate Standard Deviation**

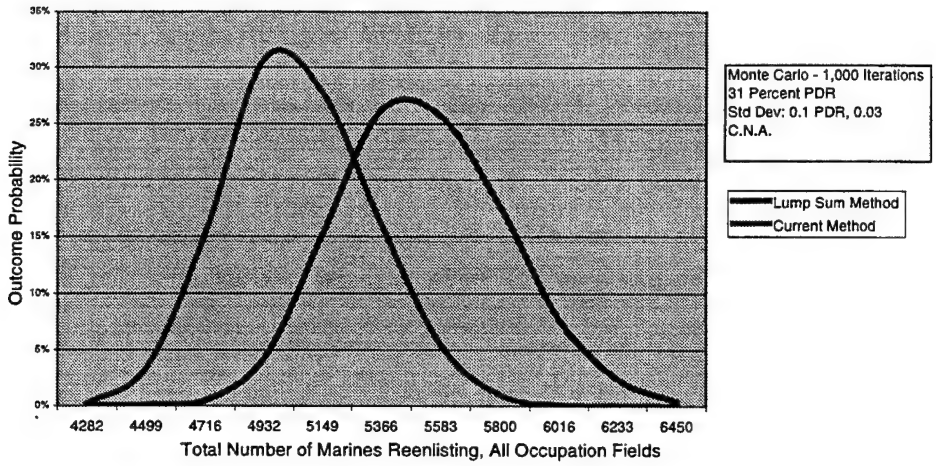


**Figure 6 - Common Histogram, Lump Sum vs. Current SRB Payment Method, 31 Percent PDR**

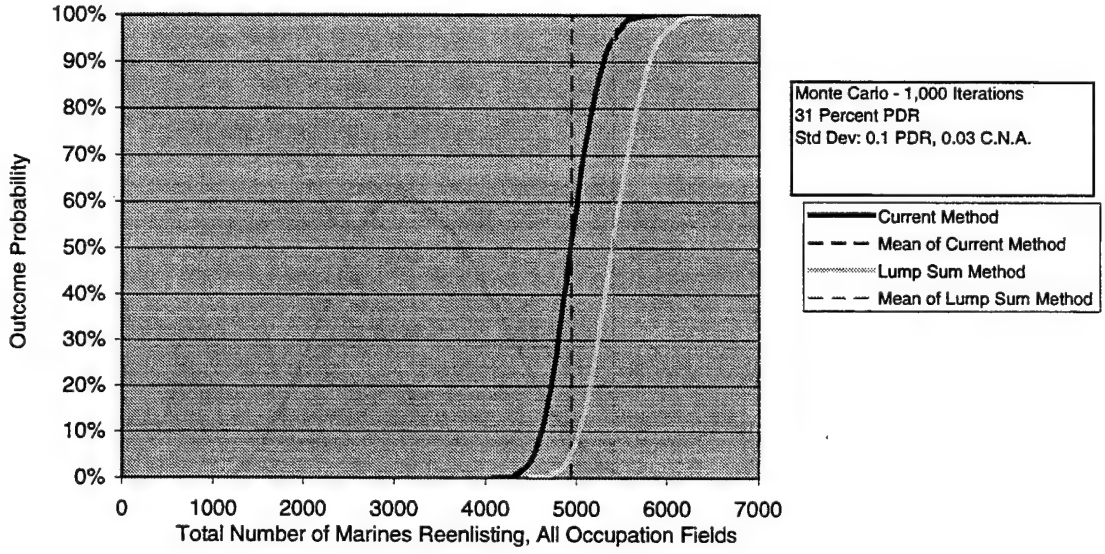


**Figure 7 - Common Cumulative, Lump Sum vs. Current Method SRB Payment Method, 31 Percent PDR**

| Output Name | Current Method | Lump Sum Method |
|---|---|---|
| **Average** | 4947 | 5409 |
| **Std Dev** | 266 | 302 |
| **Std Err** | 8.42 | 9.58 |
| **Max** | 5847 | 6449 |
| **Min** | 4065 | 4460 |

**Table 14 - Reenlistments, Lump Sum vs. Current Method SRB Payment Method, 31 Percent PDR with 0.1 PDR Standard Deviation and 0.03 C.N.A. FY 2000 Retention Estimate Standard Deviation**

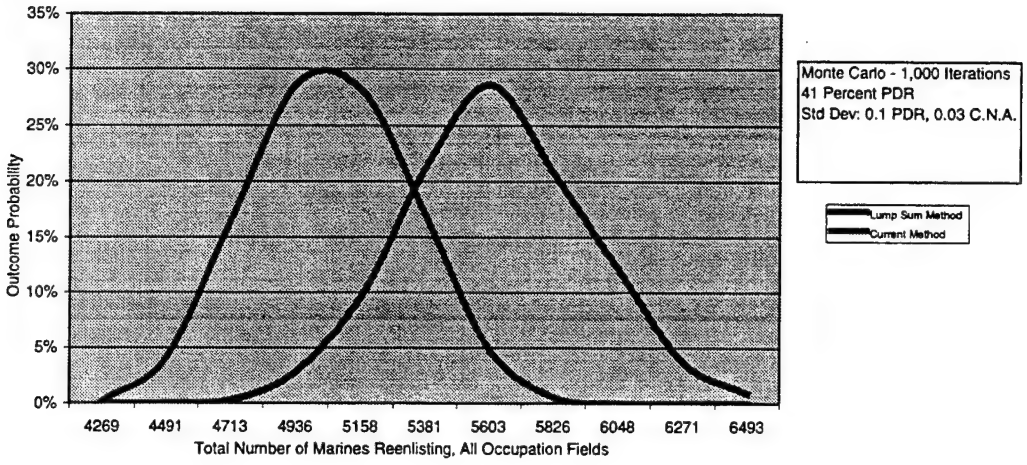


**Figure 8 - Common Histogram, Lump Sum vs. Current SRB Payment Method, 41 Percent PDR**

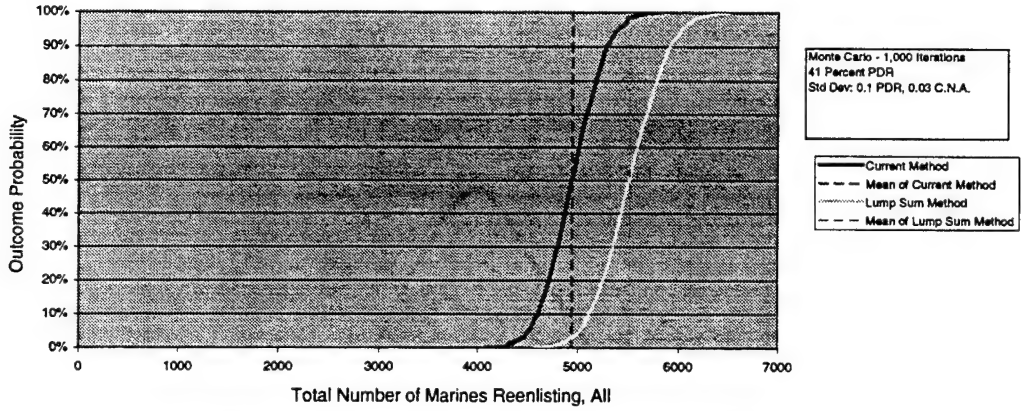


**Figure 9 – Common Cumulative, Lump Sum vs. Current SRB Payment Method, 41 Percent PDR**

| Output Name | Current Method | Lump Sum Method |
|---|---|---|
| **Average** | 4940 | 5513 |
| **Std Dev** | 270 | 310 |
| **Std Err** | 8.54 | 9.81 |
| **Max** | 5773 | 6493 |
| **Min** | 4046 | 4516 |

**Table 15 - Reenlistments, Lump Sum vs. Current Method SRB Payment Method, 41 Percent PDR with 0.1 PDR Standard Deviation and 0.03 C.N.A. FY 2000 Retention Estimate Standard Deviation**

Each page above shows the common histogram, common cumulative, and the statistics that were generated from for the three PDRs of 21 percent, 31 percent, and 41 percent. The outcomes compare the total number of Marines (in all Occupational Fields) who are predicted to reenlist using the current SRB payment method to those Marines who are predicted to reenlist using the lump sum SRB payment method. The common histogram and common cumulative are just different ways of showing the same data on each separate page.

On the left side (Y axis) of the common histogram and common cumulative charts are the probability of obtaining an outcome of a particular number of Marines reenlisting. The bottom of each chart (X axis) shows the total number of Marines predicted to reenlist for each given probability. Two conclusions can be drawn from these comparisons: 1) The probability of obtaining a "given" number of Marine reenlistments increases when using the lump sum SRB payment method; and 2) The higher the personal discount rate is, the greater this difference in "probability increase" will be.

The effects of the non-negative real world constraints on PDR and retention estimates were negligible due to the low standard deviations input into the model. The chapter four analysis predicted 4,926 FTAP Marines using the current SRB payment method and 5,260, 5,388, and 5,500 FTAP Marines for PDRs of 21 percent, 31 percent and 41 percent respectively. The "averages" for the Monte Carlos simulations were 4,934, 4,947, and 4,941 FTAP Marines using the current SRB payment method during the three runs and 5,262, 5,409, and 5,514 FTAP Marines using the lump sum payment method with PDRs of 21 percent, 31 percent and 41 percent. These figures are summarized in Table 16 below.

| | Current Method | 21 % PDR Lump Sum | 31 % PDR Lump Sum | 41 % PDR Lump Sum |
|---|---|---|---|---|
| Chapter 4 Analysis | 4,926 | 5,260 | 5,388 | 5,500 |
| Chapter 5 Analysis | 4,934 | 5,262 | | |
| | 4,947 | | 5,409 | |
| | 4,941 | | | 5,514 |

**Table 16 – Comparison of Chapter Four "Range" FTAP Reenlistment Estimates vs. "Average" Monte Carlo FTAP Reenlistment Estimates**

Table 16 shows the non-negative effects of erroneously predicting greater retention are not present in the Monte Carlo simulations.

Another notable item is that the actual FY 2000 FTAP goal is 5,799 Marines. [Ref 30] The reason this model does not accurately reflect the achievement of this goal using the current SRB payment method is because the Marine Corps also relies on lateral moves from historically restricted/overstaffed Occupational Fields to "short" occupational fields, thus historically making up the difference. These restricted reenlistment fields are not offered a SRB. FY 2000, however, is creating more challenges than estimated because "Marines at the end of their second and third enlistment are departing in greater numbers than anticipated." [Ref 30]

From the Monte Carlo simulation, if one were to pick a given "goal" to reenlist of 5,800 Marines, there would be no chance of achieving this goal using the current SRB payment method. There would be a 10 percent probability of goal achievement using a 21 percent PDR, a 22 percent probability of goal achievement using a 31 percent PDR, and a 30 percent probability of achievement using a 41 percent PDR.

## D. CHAPTER SUMMARY

This chapter described the methodology this thesis used in generating Monte Carlo simulations for predicting probability outcomes for FTAP reenlistments. The problems associated with increasing retention forecast "averages" due to the non-negative PDR and retention constraints were discussed. The compromise solution of limiting the model to small standard deviation rates (0.1 for PDRs and 0.03 for retention rates) was determined to be the best course to follow. The outcome of the Monte Carlo simulations demonstrated that there is an increase in probability of obtaining a given FTAP goal by changing the SRB payment method to lump sum. Increases in the "mean" PDR increased this probability "difference" (as would be expected) meaning that if the actual PDRs of Marines is high, the retention benefits of changing the SRB payment method to lump sum will be even greater.

THIS PAGE INTENTIONALLY LEFT BLANK

# VI. CONCLUSIONS

## A. RETENTION

The Marine Corps is facing one of its greatest retention challenges in many years in FY 2000. There are many hypothesized reasons why the Corps is witnessing so many leaving its ranks. Military compensation, the civilian unemployment rate, higher operation tempos, leadership, spouse job interests, life "priorities", and family stability are but a few of the factors that manpower planners are analyzing to "solve" our manpower shortages. The Marine Corps must not only compete with the civilian market, but also must be dominantly more attractive due to the extra risks, pressures, and family challenges that result from the military lifestyle. The Marine Corps must use all its tools (exit and retention surveys, leadership, etc.) to gain an understanding of exactly "what" the root cause of the unforeseen exodus is, and then derive a long-term plan to maintain our National force in readiness.

One short-term retention tool used by the Marine Corps is the Selective Reenlistment Bonus (SRB). It is used to entice additional Marines to "stay the course" and remain in the Corps; however, it cannot solve the entire retention problem. As can be expected, the Marine Corps has remained innovative and imaginative in its ideas. Marine planners are working on ways of making the payment of the current SRB more visible not only to those Marines receiving the bonus but also to other Marines who may be eligible for a SRB in the future. They are doing this by coordinating (with the Defense Finance and Accounting Service) a method to hand a "physical" check to the Marine at his/her reenlistment ceremony. This ceremony is normally performed with many of the

reenlisting Marine's peers present. Another method of making the SRB tool more effective is by changing the payment method to lump sum.

## B. PERSONAL DISCOUNT RATE

The primary research question of this thesis was to derive a reasonable forecast for the additional Marines a lump sum SRB payment would induce to reenlist. When I started my research and came across studies showing personal discount rates for military enlisted personal over 10 percent, I laughed. I stated my own perceived PDR to Dr. Mehay at somewhere around 6 percent, the going rate for certificates of deposit at Navy Federal. However, after much time (spent in research) and thought, I have come to the belief that PDRs among first-term Marines really are high.

The first assessment that should be made is that any commissioned officer reading this report falls in a demographic group that values investing in the future more than it does living for the "now." If it were not so, we never would never have invested the time necessary to complete a college degree while forgoing making money to spend. So, my gut feelings about what a reasonable PDR to use should not be imposed on the first-term Marine enlisted population.

The second assessment comes from personal observation of the large number of businesses right outside our base gates which charge exuberant interest "fees" for their services. I have been in the Marine Corps 12 years, and yet every base I have been stationed at has not been short of pawn shops, advance check cashing shops, and car dealerships; all offering our Marines a method of obtaining current consumption over future consumption and charging far more than 10 percent for their services. The airwaves around military installations are saturated with commercial advertisements for

these types of services several days prior to a military pay day. If PDRs were not high, these services simply would not exist. I am fully convinced that the lower PDR of 21 percent used in my research is on the low side for the majority of first-term Marines and that the PDR range up to 41 percent PDRs is not an unreasonable one to investigate.

## C. EFFECTS OF SRB PAYMENT METHOD CHANGE

Changing the Selective Reenlistment Bonus (SRB) payment method to lump sum will make the SRB more cost-effective and will increase first-term retention in the targeted Occupational Fields. Both the Annualized Cost of Leaving (ACOL) model and the analysis of this thesis support this finding. The thesis estimates that the magnitude of this increase will be between 6.8 and 11.7 percent additional Marines.

Although the Monte Carlo analysis was weakened by the non-negative constraints on PDR and marginal effect retention rates (discussed in Chapter V), it also showed an increase in the probability of obtaining a "given" number of FTAP Marines by changing the SRB to a lump sum payment. The higher the PDR used the greater this probability becomes. For an assumed goal of 5,800 FTAP Marines, Monte Carlos predicts the goal cannot be achieved using the current SRB payment method. Using the lump sum SRB payment method, the Monte Carlo simulation predicts about a 10 percent probability of goal achievement using a 21 percent discount rate, a 22 percent probability of goal achievement using a 31 percent PDR, and a 30 percent probability of goal achievement using a 41 percent PDR.

The ACOL model was also run using personal discount rates (PDR) of 21 percent, 31 percent, and 41 percent. The ACOL model reinforced the thesis spreadsheet analysis using CNA retention estimates in predicting an increase in retention of between 6.0

percent and 12.9 percent. The similar predictions were not surprising as the CNA retention analysis has many similarities with the ACOL model.

There are many uncertainties when attempting to incorporate human decisions into an academic modeling environment and the model created for this thesis is no exception. I would hope that the model outcomes would be somewhat accurate should Congress change the law to enable the SRB to be paid in lump sum. However, there are no guarantees my retention estimates will resemble the actual numbers that occur. There is little doubt after this analysis, nonetheless, that the effects of a SRB payment method change to lump sum will increase retention levels compared to the current SRB payment method.

## D. ASSOCIATED ADVANTAGES AND DISADVANTAGES

The advantages of switching SRB payments to lump sum are that they are more cost-efficient, more visible to Congress (dollar amounts), less limiting to decision-makers, and less vulnerable to unintentional demographic group shaping in the military. The major disadvantages of paying the SRB in lump sum are that it will be less visible to the Marine over his reenlistment period, it will temporarily increase the SRB budget (for four years) to cover both the new lump sum payments and the old method's past SRB obligations in the same year, there is the potential for the lump sum SRB recipient to "blow" the money foolishly, and the government may have a hard time recouping lump sum SRBs when the service-member defaults on his/her contract.

The author believes the advantages far outweigh the disadvantages in this case. The SRB payment may be less visible to the Marine, but the Marine will value a lump sum payment more than he/she would the future-year payments. The SRB budget would

increase in the short term, but after the four year period required to pay the "obligated" SRBs, the SRB budget would be identical to today's (assuming constant dollars and constant desired retention rates). The possibility of the Marine spending the money foolishly does exist; however, in a country based on freedom and individual rights, I don't think we should adopt a goal of taking care of our Marines by withholding money due them "for their own good." Finally, the Marine Corps does pursue individuals who default on their SRB contracts and the current reenlistment default rate is around 2 percent which is negligible. [Ref 31]

## E. AREAS FOR FUTURE RESEARCH

The following are areas for further research applicable to this thesis:

1. The administration of a properly worded direct assessment method survey to a random sample group of FTAP eligible Marines should be undertaken. This survey would provide an estimated "current" personal discount rate for our SRB targeted group. If possible, this survey would not only ask for normal demographic data, but also inquire into the attitudes our Marines have toward money and the personal wealth characteristics of our Marines and of their families. It would be of interest to compare this "survey" PDR to the PDRs used in this analysis and those in the literature.

2. If Congress does change the SRB payment method to lump sum in the future, it would be imperative to use the program switch as a natural experiment to study the "actual" effects produced by the new SRB payment method.

3. The Microsoft Excel spreadsheet and analysis tool created by the author can be made more "user friendly" for Marine manpower planners. Macro pushbuttons could be

added and Visual Basic programming be added to enable anyone to obtain model estimates for an unlimited number of scenarios.

4. Research should be done considering the impacts of making bonuses tax free to the recipient. Currently, for a SRB payment of $10,000 a Marine will receive $7,500 (25 percent withholding) and thus the true "cost" to the government is not face amount of the bonus but a switching of money from one government account to another. The effects of a tax-free bonus should be studied.

5. Analysis tools other than Monte Carlo simulation should be used in considering the impacts of changing the SRB payment method. For example, Logical Decisions for Windows (LDW), a policy analysis tool, is a decision support software program that aids in the evaluation of alternatives for any type of decision. LDW uses measures that are either numerical or descriptive to describe the qualities of the alternatives under consideration. LDW follows logical reasoning methods and allows the operator to rank factors against each other to produce both quantitative and qualitative measures of "utility." This could not only be used to assess the proposed SRB payment method change, but also to assess the reasons for Marines choosing to leave the Marine Corps.

## F. RECOMMENDATION

On February 21, 2000, Marine Lt. General Jack Klimp (Deputy Chief of Staff for Manpower and Reserve Affairs) stated, "Lump sum payments could dramatically increase the present value of the "SRB" incentive and positively influence numerous highly qualified personnel that are currently sitting on the fence." [Ref 32: p 26] This thesis agrees. The thesis supports changing the SRB payment method to a lump sum

payment. The federal government will be better off (Government's discount rate is 6.3 percent [Ref 20] ), the Marine Corps will be better off (more Marines will be retained for FTAP program which ripples to other areas such as less recruiting) and the individual Marine (with his/her high value on current consumption) will be better off. The new policy should create net social benefits.

THIS PAGE INTENTIONALLY LEFT BLANK

## APPENDIX A

Full Names of Marine Occupational Fields Analyzed in this Thesis [Ref 22]

| Occ Code | Name |
|---|---|
| 01 | Personnel and administration |
| 02 | Intelligence |
| 03 | Infantry |
| 04 | Logistics |
| 08 | Field artillery |
| 11 | Utilities |
| 13 | Engineer, construction, and equipment |
| 15 | Printing and reproduction |
| 18 | Tank and assault amphibious vehicle |
| 21 | Ordnance |
| 23 | Ammunition and explosive ordnance disposal |
| 25 | operational communications |
| 26 | Signal intelligence/ground electronic warfare |
| 28 | Data/communications maintenance |
| 30 | Supply administration and operations |
| 31 | Traffic management |
| 33 | Food service |
| 34 | Auditing, finance, and accounting |
| 35 | Motor transport |
| 40 | Data systems |
| 41 | Marine Corps exchange |
| 43 | Public affairs |
| 44 | Legal services |
| 46 | Training and visual information support |
| 55 | Music |
| 57 | Nuclear, biological, and chemical |
| 58 | Military police and corrections |
| 59 | Electronics maintenance |
| 60 | Aircraft maintenance - fixed wing |
| 61 | Aircraft maintenance - helicopter |
| 63 | Avionics |
| 64 | Advanced avionics |
| 65 | Aviation ordnance |
| 66 | Supply (new MOS) |
| 68 | Weather service |
| 70 | Airfield services |
| 72 | Air control/air support/antiair warfare |
| 73 | Air traffic control and enlisted flight crews |
| 9919 | Information Warfare? |

THIS PAGE INTENTIONALLY LEFT BLANK

## LIST OF REFERENCES


1. United States General Accounting Office, Briefing Report to Congressional Requesters, "Military Personnel Perspectives of Surveyed Service Members in Retention Critical Specialties", GAO/NSIAD-99-197BR, p. 2, August 1999.

2. United States Marine Corps, Marine Administrative Message 030/00, "First Term Alignment Plan (FTAP) First Quarter FY 00 Execution Progress Report", p. 1, 11 January 2000.

3. Quester, Aline O. and Adedeji, Adebayo M., "Reenlisting in the Marine Corps: The Impact of Bonuses, Grade, and Dependency Status," Center for Naval Analyses, CRM 91-64, p. 6, July 1991.

4. United States General Accounting Office, Report to Congressional Committees, "Retention Bonuses, More direction and Oversight Needed," GAO/NSIAD-96-42, p 2., November 1995.

5. Cylke, Steven, Goldberg, Matthew, Hogan, Paul, Mairs, Lee, "The Personal Discount Rate: Evidence from Military Career Decisions," Economic Analysis Report, Department of the Navy Deputy Chief of Naval Operations (Manpower Personnel and Training) p. 1, December 1982.

6. United States General Accounting Office, Report To The Chairman, Subcommittee On Manpower and Personnel, Committee On Armed Services, United States Senate, Navy Management and Use Of The Selective Reenlistment Bonus Program, GAO/NAIAD-85-143, p. 1, September 1985.

7. Department of Defense Directive Number 1304.21, "Enlistment and Reenlistment Bonuses for Active Members" p. 2, July 22, 1996, Incorporating change 1, January 20, 1998.

8. Fitzgerald, Major C. L., Career Planner, MPP-20, Quantico, VA, Personal interview with author 30 November 1999.

9. Mackin, Patrick C., and Mairs, Lee S., "An Introduction to the Annualized Cost of Leaving (ACOL) Model," SAG Technical Paper, SAG Corporation, Falls Church, VA, p. 6, April 1989.

10. Ehrenberg, Ronald, G. and Smith, Robert S., Modern Labor Economics, Theory and Public Policy, Addison-Wesley, 1997.

11. Mehay, Stephen L. and Hogan, Paul F., "The Effect of Separation Bonuses on Voluntary Quits: Evidence from the Military's Downsizing," Southern Economic Journal, 1998.

12. Warner, John T., Professor of Economics, Clemson University, Clemson, SC, e-mail correspondence with author, 8 March, 2000.

13. Warner, John T, and Asch, Beth J., Chapter 13, The Economics of Military Manposwer, In Hartley, K., and Sandler, T., (Editor) Handbook of Defense Economics, Vol. 1, Elsevier Science B.V., 1995.

14. Office of Management and Budget Circular No. A-94 Revised (Transmittal Memo No. 64), "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs," October 29, 1992.

15. Mackin, Patrick C., Mackie, Christopher D., and Darling, Kimberly L., "An Analysis of U.S. Air Force Retention," Contract USAF F49650-92-D5000, D.O. 5008, May 1995.

16. Warner, John T. and Pleeter, Saul, "The Personal Discount Rate: Evidence from Military Downsizing Programs," Unpublished Paper, Clemson University, April, 1999.

17. Nord, Roy D. and Schmitz, Edward J., "Assessing the Personal Discount Rate", Technical Report 673, U.S. Army Research Institute for the Behavioral and Social Sciences, Office, Deputy Chief of Staff for Personnel Department of the Army, March, 1985.

18. Boardman, Anthony E., Greenberg, David H., Vining, Aidan R., and Weimer, David L., Cost-Benefit Analysis: Concepts and Practice, Prentice-Hall, Inc., 1996.

19. O'Connell, Venessa, "Thriving Industry Buys Insurance Settlements From Injured Plaintiffs, J.G. Wentworth Pays Cash for Monthly Payments; The Price: 21 % Interest, Bobbie Jean Begs by the Road," Wall Street Journal, February 25, 1998.

20. Office of Management and Budget Circular No. A-94 Revised (Transmittal Memo No. 64), "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs," Appendix C, "Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analyses," Revised January 2000.

21. Schultz, Ellen E., "Offered a Lump Sum, Many Retirees Blow It And Risk Their Future," Wall Street Journal, July 31, 1995.

22. North, James H., "A Cost-Effective Use of Selective Reenlistment Bonuses and Lateral Occupational Moves," Center for Naval Analyses, CRM 94-105, September 1994.

23. Quester, Aline O., Memorandum for Deputy Chief of Staff, Manpower and Reserve Affairs, "Updating Estimates of Selective Reenlistment Bonus (SRB) for FY 2000 Planning," Center for Naval Analyses, (C.N.A.) 99-0532, 14 May 1999.

24. Quester, Aline O., Memorandum for Deputy Chief of Staff, Manpower and Reserve Affairs, "Updating Estimates of Selective Reenlistment Bonus (SRB) For FY 1998 Planning," Center for Naval Analyses, (C.N.A.) 97-0697, 2 June 1997.

25. North, James H., Memorandum for Assistant Deputy Chief of Staff for Manpower and Reserve Affairs, Manpower Plans and Policy, "Updating Estimates of Selective Reenlistment Bonus (SRB) and Lateral Move Costs for FY 1996 Planning," Center for Naval Analyses, (C.N.A.) 95-1182, 12 June 1995.

26. Defense Finance and Accounting Service, Monthly Basic Pay Table Effective January 1, 2000, as found at internet site: www.dfas.mil/money/milpay/2000pay/jan2000.htm on 7 Feb 2000.

27. Marine Corps Order 7220.24M, MPP-24, Subj: "The Selective Reenlistment Bonus (SRB) Program," May 7, 1990.

28. Mackin, Patrick C., SAG Corporation, personal e-mail with thesis author, March 2, 2000.

29. Savage, Sam L., Insight.xla, Business Analysis Software for Microsoft Excel, Brooks/Cole Publishing Company, Pacific Grove, CA, 1998.

30. United States Marine Corps, All Marine Message 011/00, "Retention" p. 1, 18 February 2000.

31. Fitzgerald, Major C. L., Career Planner, MPP-20, Quantico, VA, e-mail correspondence with author, 10 March, 2000.

32. Maze, Rick, "DoD Mulls Lump Sum Payment of Bonuses," The Navy Times, March 6, 2000.

THIS PAGE INTENTIONALLY LEFT BLANK

## INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center ..... 2
   8725 John J. Kingman Road, Ste 0944
   Fort Belvoir, VA 22060-6218

2. Dudley Knox Library ..... 2
   Naval Postgraduate School
   411 Dyer Road
   Monterey, CA 93943-5101

3. Director, Training and Education ..... 1
   MCCDC, Code C46
   1019 Elliott Road
   Quantico, VA 22134-5027

4. Director, Marine Corps Research Center ..... 2
   MCCDC, Code C40RC
   2040 Broadway Street
   Quantico, VA 22134-5130

5. Director, Studies and Analysis Division ..... 1
   MCCDC, Code C45
   3300 Russell Road
   Quantico, VA 22134-5130

6. Marine Corps Representative ..... 1
   Naval Postgraduate School
   Code 037, Bldg. 330, Ingersoll Hall, Rm 116
   555 Dryer Road
   Monterey, CA 93940

7. Marine Corps Tactical Systems Support Activity ..... 1
   Technical Advisory Branch
   Attn: Major J.C. Cummiskey
   Box 555171
   Camp Pendleton, CA 92055-5080

8. Professor Stephen L. Mehay ..... 2
   Code SM/MP, Bldg. 330, Ingersoll Hall, Rm 304
   Naval Postgraduate School
   Monterey, CA 93943

9. Professor John T. Warner ..... 2
212 Sirrine Hall
Clemson University
Clemson, SC 29634

10. Major Cheryl Fitzgearld ..... 3
Department of the Navy Headquarters USMC
3280 Russell Road
(MPP-20)
Quantico, VA 22134-5103

11. Major David Ross
312 Metz Road
Seaside, CA 93955 ..... 2